

ABSTRACT

Title of Thesis:

MANUFACTURED HOMES AND
THEIR COMMUNITIES: MOBILITY
OF AN AMERICAN VERNACULAR

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Directed by:

Professor Emeritus Ralph Bennett,
School of Architecture, Planning, and
Preservation

Manufactured homes and communities have acquired the stigma of being low-income housing associated with transient citizens. In actuality, park residents tend to remain part of a community for extended periods of time; rarely are structures relocated today. This housing typology presents a multitude of opportunities in the realms of density, community, and affordable living. While the historic roots of these homes grew out of travel and mobility, the desire for larger living spaces has all but removed this characteristic from these homes. This thesis aims to redesign the manufactured home and rethink park design in order to re-integrate 'trailer parks' into existing urban fabrics and create a transportable home. Thoughtful design and planning can rekindle enthusiasm for this housing type and lifestyle.

MANUFACTURED HOMES AND THEIR COMMUNITIES:
MOBILITY OF AN AMERICAN VERNACULAR

By

Sarah Colvin

Thesis submitted to the Faculty of the Graduate School of the
University of Maryland, College Park, in partial fulfillment
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Dedication

To my grandparents:

First and foremost to William Ballou, who moved his family across the country in a mobile home and truly inspired this project.

June 26, 1934 – February 26, 2011

To Shirley Thacker, who has taken care of that mobile home so I could become curious.

To William and Veta Colvin, who have always been there to answer my questions not only about their double-wide manufactured home, but life in general.

Acknowledgements

I would like to thank:

My Committee

Ralph Bennett

Don Linebaugh

Brian Kelly

- for motivating me to continue and not giving up

My Family

- for making sure I was alive and well
- for always understanding
- for the love and support

My Friends

- for encouraging me and believing in me more than I could believe in myself
- for listening to me complain
- for running around on a llama farm
- for reminding me to breath
- for holding me to higher standards
- for giving me something to look forward to
- for reminding me what is important
- for tea breaks
- for helping me move
- for letting me know when I'm in my own way

I could not have done it alone.

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Introduction

Much of what is considered ‘American Vernacular’ stems from traditions brought from overseas and adapted to a new environment. The development of the American ‘mobile home’, now called ‘manufactured housing’, is a history that spans nearly a century. Despite their use during significant moments in U.S. history, manufactured homes have not been preserved or documented like other historically significant structures. With thousands of homes nation-wide, only one community in Los Angeles, California has been recognized as historically significant at a local level and still none are recognized at a national level.

Understanding the history of manufactured homes establishes a foundation to evaluate current practices and standards. There seems to be a general lack of interest in the manufactured home industry resulting in little advancement in design and build processes. With little effort to document the history of manufactured homes and improve industry standards, there is a missed opportunity for affordable housing. This thesis aims to use history and current conditions to influence and rethink manufactured home and community design.

The approach is to first look closely at the history and progression of manufactured homes from the 1920’s to present day while identifying issues that found the negative associations with the housing type. Next follows the documentation of current conditions and practices of the industry to provide points of comparison. Beginning to enter into more direct influences on the design proposal is the site and what restrictions the environment provides. The design proposal then moves forward taking the findings of research and exploration into consideration.

Chapter 1: History/Background

The history of manufactured homes can act as a precedent for future design and better industry practice; analysis of past successes and controversies can inform design decisions to move the industry forward and not repeat history. Also realizing who typically have called these structures home and where they live determines where ideal locations for application may be.

General Timeline

The manufactured home of today's "trailer parks" evolved from the travel trailers of the 1920's, then a recreational automobile accessory. By 1938, the AAA estimated that around three hundred thousand trailers, three quarters homemade, were in use by almost one million 'trailerites'.¹ During WWII trailers became the answer for the immediate housing needs of the military, marking a shift to the 'trailer house' era. Of the housing units purchased during the war, seventeen and half percent of prefabricated units were trailers. Viewed as a temporary solution, the plan after the war was to sell or scrap the trailers; most ended up on college campuses as accommodations for returning veterans² and married students.³

World War II was a major turning point in the use of trailers as year-round homes versus vacation accommodations. Before the war, vacationing was the principle use for seventy-five to ninety percent of all commercially manufactured trailers. Ninety percent of trailers manufactured during the war and into the early 1950's were used for year

¹ Wallis, Allan D. "House Trailers: Innovation and Accommodation in Vernacular Housing." *Perspectives in Vernacular Architecture* 3 (1989): p. 29-30.

² Wallis

³ Hart, John Fraser., Michelle J. Rhodes, and John Morgan. *The Unknown World of the Mobile Home*. Baltimore: Johns Hopkins UP, 2002. p. 12

round housing.⁴ As the housing demand declined and residents were becoming less nomadic, trailers became wider and the ‘mobile home’ era began; ninety percent of mobile homes were ten feet wide by 1960.⁵ The nomenclature would change once more as a result of the Housing Act in 1980, which required that these structures be referred to as ‘manufactured housing’.⁶ Although the legal term became manufactured housing, many census forms still enumerate ‘mobile homes’ rather than ‘manufactured housing’ even thirty years after the law was passed.

Physical Characteristic Timeline

Early homemade trailers, intended for temporary use and more frequent mobility, were much smaller than today’s standard and were limited based on road dimensions. Average sizes were limited by some states to 6 ½ to 8 feet wide and a length of 17 to 21 feet in 1940.⁷ With growing popularity, model designs became larger and more complex; William Stout developed a compact folding trailer, Corwin Wilson a double-decker trailer, the Durham Car Company the double-wide to look like site built homes. William Stout’s design was one of the two main trailer types the government used during the war. The other trailer type was an 8 foot by 22 foot trailer costing \$750. Because people were living in trailers year-round during the war, some trailers were expanded in length to 55’. Outward appearances began changing from the exterior streamline look to accommodate the rationing of materials, specifically metals.⁸

⁴ Wallis p. 34

⁵ Wallis p. 37

⁶ Hart p. 3

⁷ Hart p. 8

⁸ Wallis p. 31-36

It was in the mid-to late 1950's that the 10' wide mobile home was introduced by Elmer Frey, allowing for a hallway to be incorporated in the floor-plan. Mobility slowly became a less important quality in trailer design; 10' wide trailers were not impossible to pull behind a family-owned car, but more difficult.⁹ Today it seems that only 'recreation vehicles' or RV's are towed behind the family car. The average size of a single section manufactured home in 2008 had a square footage of around 1,105 square feet.¹⁰ With a footprint of 1,105 square feet, these single section homes are typically larger than 14 feet wide by 75 feet in length. The greatest progression in home dimensions occurred between the 1950's and 1970's, as can be seen in Figure 1.

⁹ Wallis p. 37

¹⁰ "Quick Facts 2010." *Quickfacts 2010*. Manufactured Housing Institute. Web. 15 Jan. 2011. <http://www.manufacturedhousing.org/media_center/quick_facts/default.htm>.

<div>8' x 25' 200 sq. ft.</div> <div>10' x 55' 550 sq. ft.</div>	<p>1959</p> <p>28.2% = 8' wide</p> <p>78.1% = 10' wide</p>
<div>10' x 55' 550 sq. ft.</div> <div>12' x 60' 720 sq. ft.</div>	<p>1964</p> <p>0.7% = 8' wide</p> <p>74.3% = 10' wide</p> <p>12.3% = 12' wide</p>
<div>12' x 60' 720 sq. ft.</div>	<p>1969</p> <p>0.3% = 8' wide</p> <p>0.6% = 10' wide</p> <p>89.7% = 12' wide</p>
<div>12' x 60' sq. ft.</div> <div>14' x 65' 910 sq. ft.</div>	<p>1972</p> <p>0% = 8' wide</p> <p>0.1% = 10' wide</p> <p>68.3% = 12' wide</p> <p>16.7% = 14' wide</p> <p>0.3% = 16' wide</p>

Figure 1 Mobile Home Dimensions - First Quarter Shipments¹¹

¹¹ Davidson, Harold A. *Housing Demand: Mobile, Modular, or Conventional?* New York: Van Nostrand Reinhold, 1973. P. 24-25

Demographics

The first residents of travel trailers are hard to identify as one clear demographic group; the notion of mobile, year-round living caught on for itinerant workers, including labor workers, salesmen, etc. who could now travel with their families.¹² WWII resulted in a shift in trailer use; mobile homes allowed military families to be more easily relocated to bases across the country. Into the 1950's trailer houses mainly served construction workers and military families. With the end of the war and end of the housing crisis, the 1960 census reported a shift in demographics to younger, less educated residents.¹³ Manufactured homes have also become a quick answer for disaster areas where large numbers of homes have been damaged. For the elderly who are not yet ready for a nursing home, but cannot fully take care of themselves, manufactured homes can be installed near a family's permanent home to provide a temporary residence.¹⁴

Residents of today's manufactured homes tend to be older couples who have little need for a great amount of space; the highest percentage of residents are between the age of 50-59 years of age and have two members within the household; about 50% of head of households in manufactured homes are between 40 and 60 years of age.¹⁵ As can be seen in Figure 2, the majority of manufactured housing residents are full time employees and have a median income of \$34,700.¹⁶

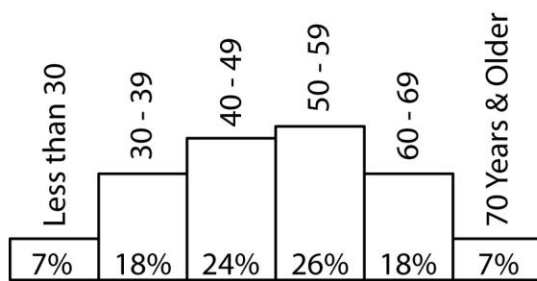
¹² Wallis p. 31

¹³ Wallis p. 35-37

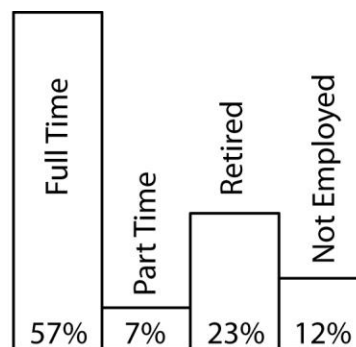
¹⁴ Hart p. 26

¹⁵ Quick Facts 2010

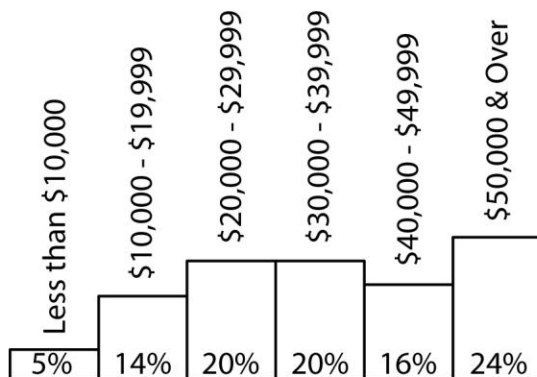
¹⁶ Quick Facts 2010



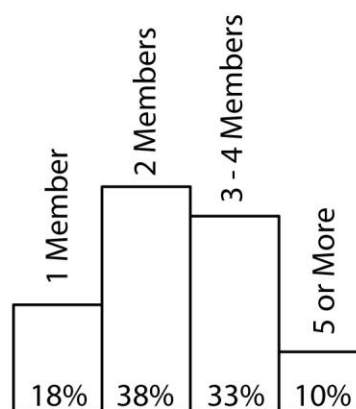
Age of Household Head



Employment Status of Household Head



Annual Household Income



Household Size

Figure 2 2008 Demographics¹⁷

Legal Considerations - Zoning

Controversy concerning the location of manufactured homes began as early as the 1930's, with attempts to regulate duration of stay.¹⁸ One of the first court cases to deal with the issue was *People v. Gumarsol* in 1936. In the summer of 1935, Hildred Gumarsol parked a travel trailer on a rented lot, removed the wheels, built a porch, and left it during the winter season to return the next summer. Neighbors used the argument

¹⁷ Quick Facts 2010

¹⁸ Wallis 28-30

that the dwelling was illegal because it was less than 400 square feet, a locally defined requirement; Gumarsol argued that it was not a dwelling at all, but an automobile accessory.¹⁹ This debate over whether trailers are vehicles or dwellings continued for many years.

Zoning and regulation on placement of trailers has fluctuated with the changing times and events; the war era played a crucial role in the development of mobile homes in every aspect. During the war, zoning was often relaxed to accommodate the great need for housing in specific areas; municipalities quickly resumed exclusionary zoning following the war. Based on the physical characteristics of trailers, built on a chassis with wheels, local governments argued that trailers were not dwellings but vehicles and would not be zoned residential. Tight restrictions forced mobile homes to the unincorporated edges of towns and cities in industrially and commercially zoned areas often adjacent to major thoroughfares.²⁰

Into the 1960's, municipalities believed that mobile home owners were not assets and did not pay their weight in taxes, therefore did not want them in their communities. Based on the arguments that trailer parks could be considered businesses and that health and safety might be an issue, zoning exclusions were found to be legal.²¹ In 1970 President Nixon legitimized mobile homes as a permanent housing type and between 1974 and 1976 HUD developed and employed building and safety standards for mobile homes. Siting discrimination became illegal in fourteen states by 1985.²² Over 80% of all manufactured homes were located outside of urbanized areas in 1995, mainly in rural

¹⁹ Hart p. 10-11

²⁰ Wallis p. 36-38

²¹ Mays, Arnold H. "Zoning for Mobile Homes: A Legal Analysis." Journal of the American Planning Association 27.3 (1961). EbscoHost. Web.

²² Wallis p. 42

settings.²³ By 2002, about half of the states outlawed discriminatory zoning but manufactured home owners still have to fight some local ordinances.²⁴

Siting - Parks

It has been estimated that a little less than half of the nation's manufactured homes reside within a park community; most homes stand on privately owned parcels. Parks can consist of rented lots or 'freehold' communities in which the structure and the land belong to the owner.²⁵ The government constructed about 8,550 spaces in the house trailer era during the war. From the 1940's until 1972 the Land Development Division of the Mobile Home Manufacturers Association created tens of thousands of new mobile home spaces. Layouts of these parks were based on orientation to the street, occasionally with an office located in front of the park, an idea taken from earlier campgrounds. Packages were also offered to make a structure more permanent when on its site by providing amenities such as carports, patios, etc.²⁶

Theory

The term 'mobile home' came about because of a marketing strategy, but it has since become the most familiar way to identify a specific housing type although the nomenclature has changed. Given that a little over seven percent of the United States lives in this type of manufactured housing, whether because it is affordable or it is their

²³ NAHB Research Center, Inc., comp. *Factory and Site-Built Housing: A Comparison for the 21st Century*. Rep. U.S. Department of Housing and Urban Development, Oct. 1998. Web. 15 Jan. 2011. <<http://www.huduser.org/publications/pdf/factory.pdf>>. p. 21

²⁴ Hart p. 28

²⁵ Hart p. 26-27

²⁶ Wallis p. 34-38

chosen lifestyle, the manufactured home is a legitimate housing type. Anthropologist Amos Rapoport explores the idea of the home in U.S. culture:

What then does “house” mean to Americans? They have a dream “home—the very word can reduce my compatriots to tears,” and builders and developers never build houses, they build homes. The dream home is surrounded by trees and grass in either country or suburb, and must be *owned*, yet Americans rarely stay in it more than 5 years. It is not a real need but a symbol. This symbol means a freestanding, single family house, *not* a row house, and the ideal of home is aesthetic, not functional.²⁷

In certain scenarios manufactured homes fit nicely into the American dream that Rapoport defines, but popular culture has given the communities a reputation as a particular type of American slum. While this negativity has followed the housing type since its inception in the early 20th century, manufactured homes have survived in abundance.

Community in a mobile home park is distinct; in driving through one might see more people out interacting, children playing together than in a typical suburban neighborhood today. Considered as early as the 1960’s as a ‘horizontal apartment’ complex, these groups of homes can relate to many standard and socially accepted residential institutions. Like site built home neighborhoods, value can vary from low to high; some communities live up to their stigma of unsafe and poorly kept, but others are gated communities with high end amenities. In theory, manufactured homes are movable and so could potentially shift communities more easily, although very rarely are they moved after being sited.

²⁷ Rapoport, Amos. *House, Form, and Culture*. Upper Saddle River : Prentice-Hall, Inc. 1969. P. 132-133

Chapter 2: Issues

Part of the goal of this thesis is to engage the negative association of manufactured housing in hopes of producing a socially acceptable solution. To do so, positive and negative characteristics of manufactured housing need to be identified; at which point conclusions may be drawn as to which issues may be resolved.

Community

Community spaces in residential areas are important, even more so when personal space is limited. Manufactured home parks present a unique social environment due to the close proximity of personal spaces. Unlike apartment complexes, there is space between residences, and unlike suburban neighborhoods, the spaces in between really belong to the park and not the individuals. Due to the small private spaces of the manufactured homes, manufactured home parks are conducive to social interaction in exterior spaces seemingly more so than conventional residential neighborhoods.²⁸

Thomas Fisher observes about our neighborhoods that "...so many of our suburbs have become places where we elevate personal consumption over community cohesion, and where we prize security over solidarity with people other than ourselves"²⁹, it is possible that the manufactured home community contradict this notion.

There is also a larger community connection, which is the overall manufactured home community. All across the nation there are manufactured home parks that have the same look and appearance as one thousands of miles away. If residents move themselves

²⁸ Hart p. 81

²⁹ Fisher, Thomas. *In the Scheme of Things: Alternative Thinking on the Practice of Architecture*. Minneapolis: University of Minnesota, 2000. P. 18

and/or their home to a new location, there may still be a feeling of the original, familiar community; “everyone living in a mobile home park lives in a mobile home, and some might find this reassuring”.³⁰ As seen in employment demographics and the history of migrant workers living in manufactured housing, a group of residents may contain a variety of talented artisans. The community could be self sufficient in terms of maintenance and helping one another by the pooling of knowledge and skills.³¹

Ownership

The importance of ownership is emphasized in Rapoport’s description of the American dream. Manufactured home parks present an intermediate space of ownership; the majority of communities are organized in such a way that the structures are owned by the residents, but the land is owned by another party then rented or leased. There are “freehold” communities in which residents own land and structure.³² In the more common cases of land rental, there is always the possibility of a park being sold leaving residents to abandon, sell, or move their home. Some ideal approaches to this situation include the park offering residents the right of first refusal, giving timely notice so residents can sell or relocate, and also offering to buy the homes or pay for relocation. To avoid this situation in the first place, some parks are turned into or structured as condominiums or a cooperative.³³ Ownership of a home allows for people to express

³⁰ Harries, Karsten. "9. Tales of the Origin of Building." *The Ethical Function of Architecture*. Cambridge, MA: MIT, 1997. P. 146

³¹ Hart p. 81-82

³² Hart p. 26

³³ Hart p. 81

themselves through their dwellings, “it is indeed hard ‘to live in a place that is not our own and, much more, not ourselves.’”³⁴

Permanence

The history of the transition from travel trailer to manufactured home is one which the structures have become more suited for permanent living. The expense to move an already sited home greatly outweighs the total cost of selling and buying another in an alternate location. In some cases the manufactured home is permanently attached to the foundation on a site, leaving home owners who rent the ground feeling trapped, literally having the option of mobility taken away.³⁵ An interesting guideline in the HUD Home Builders’ Guide to Manufactured Housing lists the removal of all transportation materials (hitch, taillights, cables, springs, axles and wheels) as a step in the set-up process on a site.³⁶

Financing

The ability to hook up to a home and move it, has made banks wary of giving loans to manufactured home residents in the past. The manners of production and final siting also have an impact on designation of property type. Manufactured homes have traditionally been an affordable housing type; the cost of a square foot in 1997 was \$25.78 (single section), and \$30.65 (double section) while the cost per square foot of a

³⁴ Harries p. 151

³⁵ Hart p. 79-80

³⁶ *Home Builders’ Guide to Manufactured Housing*. Upper Marlboro: NAHB Research Center, 2000. HUD. Web. 15 Jan. 2011.
<<http://www.huduser.org/portal/publications/destech/homeguide.html>>. p. 34

site-built home was \$61.47.³⁷ By 2008 the average price per square foot of a site-built home had risen to \$88.55. Similarly the cost per square foot of manufactured housing rose to \$34.48 (single section) and \$42.87 (multi-section) on average.³⁸

In the case of a park owner who also owns a dealership, an arrangement called a ‘tie-in’ can be made giving control of a park’s structures to the owner. A tie-in requires that tenants of a park buy their homes, or other goods and services, from the owner. This process has the potential to regulate the quality of a park by including only owner approved structures; tie-in homes also mean the price of the homes may be higher based on the dealer/owner’s decision.³⁹

The leading issue concerning financing and taxing of mobile homes is their designation as either personal or real property. Because of the way these structures are constructed and transported, ownership traditionally resembles that of an automobile, literally issuing a vehicle title like a car. If the manufactured homes are sited on permanent foundations and tied to the land, owners have a greater chance of being financed as real property using conventional mortgages. As personal property, not attached to land, a manufactured home may be financed through a “retail installment loan contract,” with a typical loan period of five to ten years. Taxes on manufactured homes similarly depend on whether they are considered real or personal property.⁴⁰ However, generally in park situations that have rented the land to homeowners, the homeowners pay personal property tax and the park pays the real estate tax.⁴¹ Whether or not homes

³⁷ Hart p. 5

³⁸ Quick Facts 2010

³⁹ Hart p. 80

⁴⁰ HUD p. 37

⁴¹ Hart p. 78

on leased lots qualify for conventional mortgages or consideration as real property depends on state regulations.⁴²

Both types of property can be used as collateral, but real property may be foreclosed upon while personal property will be repossessed.⁴³ Permanent foundations play a big part in whether or not a manufactured house can be repossessed without significantly damaging the structure. Many manufactured homeowners feel that the structure they live in is a permanent and very real property.

Transportation

Stresses on the structure of a manufactured home are initially different than those on a site built home. Because these structures are transported potentially very long distances, the torsional and transverse stresses can be substantial. Built on a chassis system, manufactured housing has moved further from designing a home on top of a typical durable steel structure. Giving more strength to the shell of the home reduces the need for a more structural base. Unfortunately without enough strength in the chassis system the overall structure is more likely to bend and shift in transport, potentially causing significant damage to openings and finishes.⁴⁴ Logically, smaller homes are more compact and can be transported more easily. Larger homes may require more interior walls to provide structural stability to resist stresses during transportation. In addition to structural stability limitations, state highway administrations limit load widths and require permits to exceed that dimension.

⁴² HUD p. 40

⁴³ HUD p. 37

⁴⁴ U.S. Department of Housing and Urban Development Office of Development and Research. *Innovations at the Cutting Edge: New Ideas in Manufactured Housing*. Washington, D.C.: PATH, 1999. p. 34-36

Installation

Manufactured homes are built to be transported at least once, but many factors can affect whether or not a home makes it to its site in optimum conditions. The HUD codes, established in 1976, have brought standards of construction to a higher level of quality. It has been questioned though, whether or not the inspection process during installation of manufactured homes is stringent enough; when inspectors can be employees of the manufacturer or unqualified for the position, the homeowners are at risk.⁴⁵ “The HUD-Code does not regulate the installation of manufactured homes at the site nor does it specify the how the individual sections are to be joined and set-up at the site”; state and local governments decide the regulations and inspection process for manufactured home installation.⁴⁶ In 1999 the American Association of Retired Persons surveyed a group of manufactured housing residents and 77% reported some problem with the construction or installation of their home and appliances. Another account by an expert revealed installation deficiencies or failings in 90% of over one thousand homes inspected in twelve states.⁴⁷

⁴⁵ Hart p. 23-24

⁴⁶ HUD p. 31

⁴⁷ Rust, Adam. *This Is My Home: the Challenges and Opportunities of Manufactured Housing*. Durham: Carolina Academic, 2007. P. 10

Infrastructure – Systems and Energy

Often manufactured home communities are built on very basic infrastructure. The HUD guidelines set up regulations on utilities built within the structures, but do little to explain how park infrastructures are to be laid out. Drainage is addressed, and placement of utility connections is to correspond with the structure siting; the most specific guideline is that in land-leased communities, a connection for electric is to be provided.⁴⁸

With limited space in a manufactured home, air conditioning, electrical and mechanical systems must be small and efficient. Various studies have led to the discovery of more effective systems. For example, studies have shown an improvement in performance and energy use of ductwork in the floor system as opposed to an attic system.⁴⁹ Energy statistics for manufactured homes in 2005, which are around 7% of residences, indicate that they are responsible for only 5% of the estimated overall residential energy use; 27% of these residences use natural gas, 42% use electricity, 3% use fuel oil, 19% use LPG, and 4% use kerosene. A smaller percentage of manufactured homes have appliances than single family homes: 87% have clothes washers, 78% have clothes dryers, and 49% have a personal computer.⁵⁰

⁴⁸ HUD p. 32

⁴⁹ PATH p. 56-58

⁵⁰ *Using and Saving Energy In Homes*. U.S. Energy Information Administration. Web. 15 Jan. 2011. <http://www.eia.doe.gov/kids/energy.cfm?page=us_energy_homes-basics>.

Chapter 3: Current Conditions and Practices

The history of manufactured homes begins to explain the roots of the negative stereotypes; current conditions can identify characteristics that may be promoting or combating negativity. Connotations differ within the context of singular manufactured homes versus an aggregation. It is important to look at the current practices of home building and community design to understand the extent of possible manufactured home environments.

The Homes

With the limitations of transportation influencing shape and size of homes for years, floor plans of single section units remain similar to plans of fifty years ago.

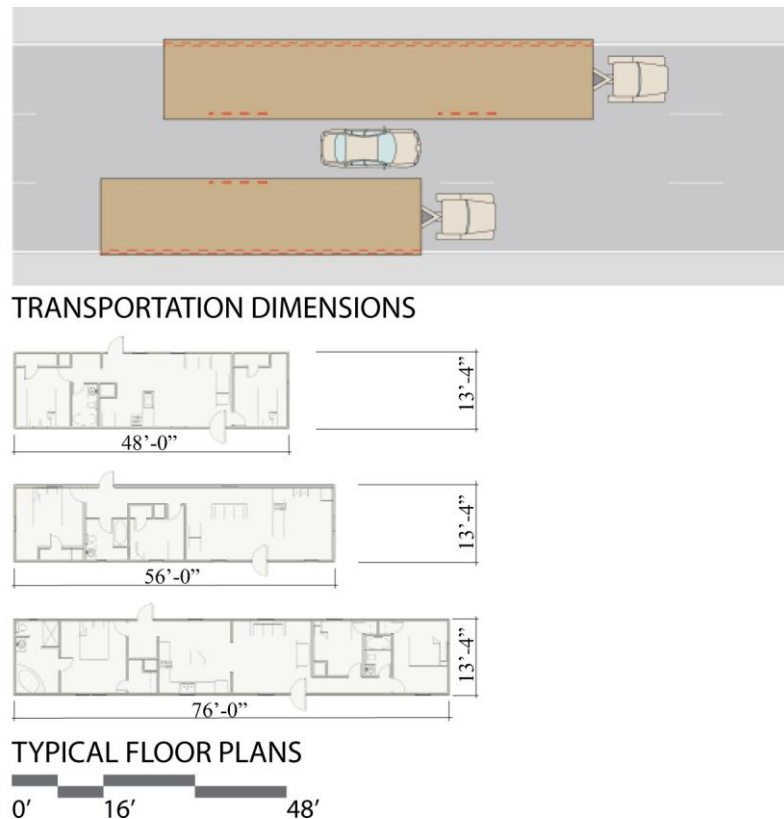


Figure 3 – Typical Plans and Transportation Dimensions

In general, early manufactured homes were not intended to withstand years of use but homes as old as 50 years of age can be found mixed among modern homes. Trends occur within communities themselves; older communities tend to have a wider range of age to their homes while newer communities have contemporary model homes. Figure 4 is a collection of images from a few longer established communities from Virginia and Maryland. Compared with a younger community from Maryland, as seen in Figure 5, the progression in home design characteristics can be seen. There has been a shift from the airstream, automobile design of the 1950's and 1960's to gable roofs, mimicry of site built homes.



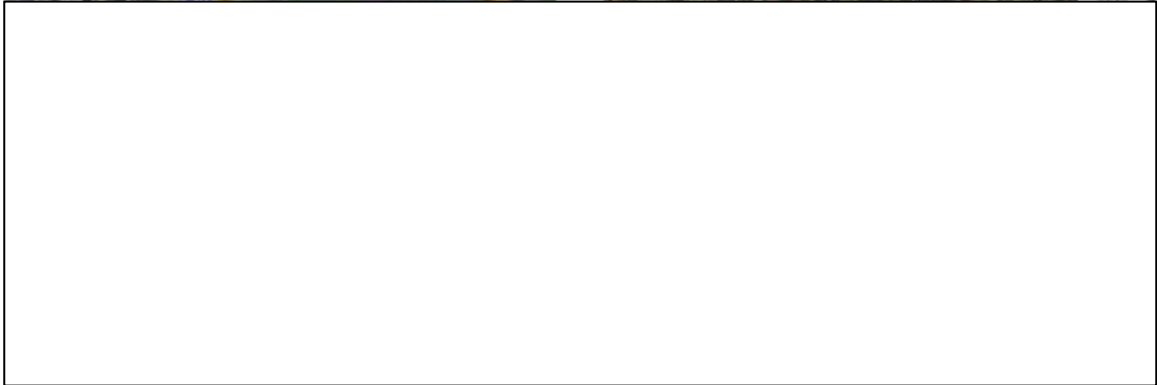
Figure 4 - Older Homes/Communities of Maryland and Virginia



Figure 5 - Newer Homes/Community of Maryland

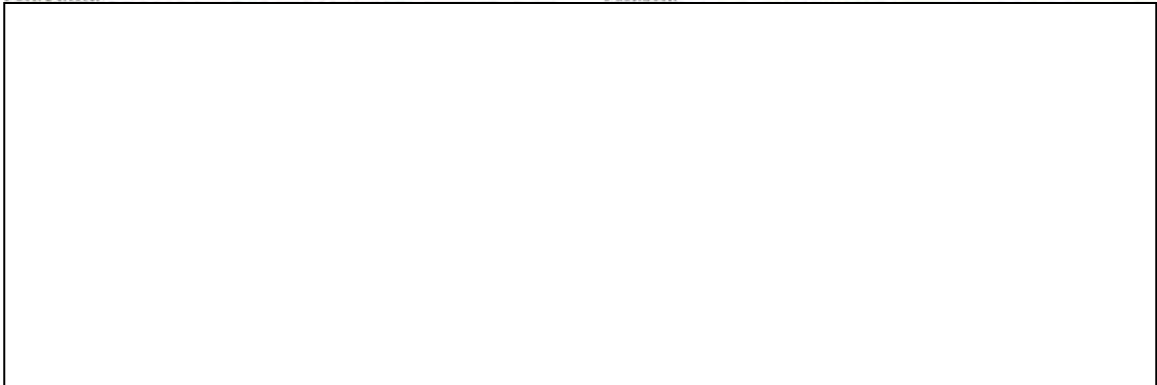
Mapping – Communities across the Country

With the exception of the state of Hawaii, manufactured home communities scatter the United States from Alaska to the Florida Keys. Varying in more than size, age, and configuration, these many parks provide insight into approaches to layouts. Similarities in many parks reveal that despite climate differences community design and the homes themselves remain generic across the landscape.



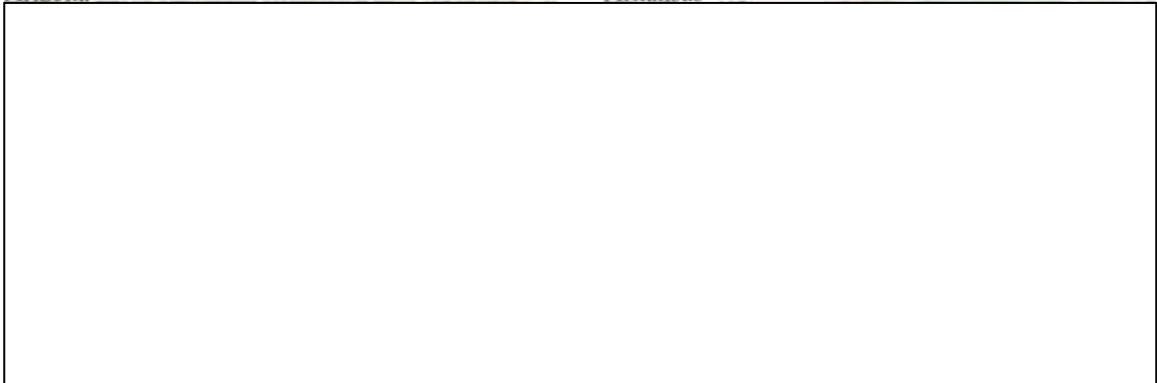
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Alaska



Arizona

Arkansas



California

Colorado



Connecticut

Delaware

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Florida

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Idaho

Illinois

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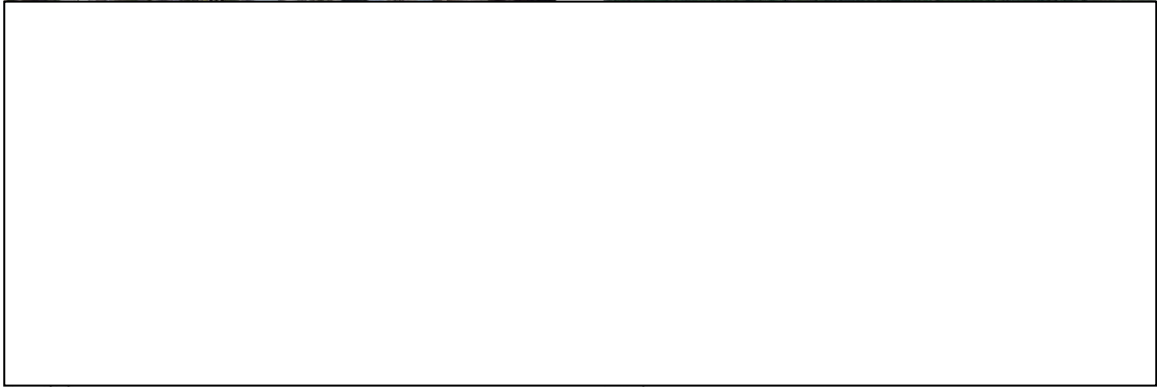
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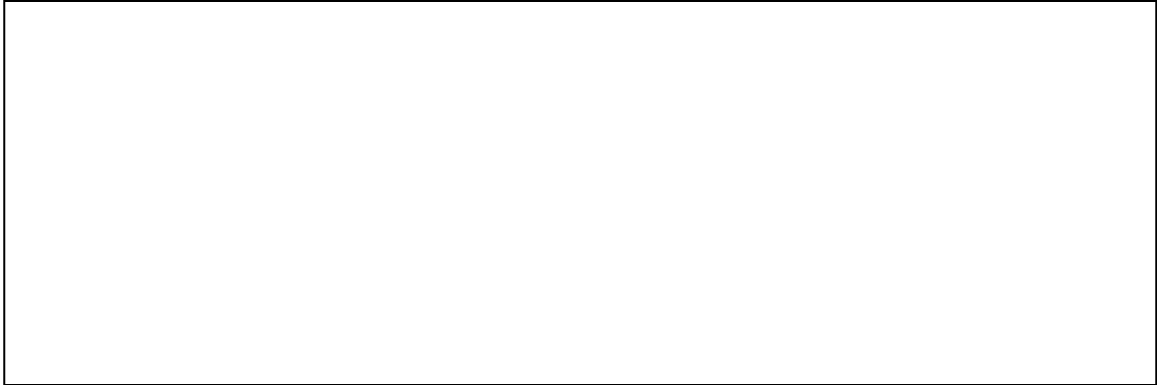
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Kentucky



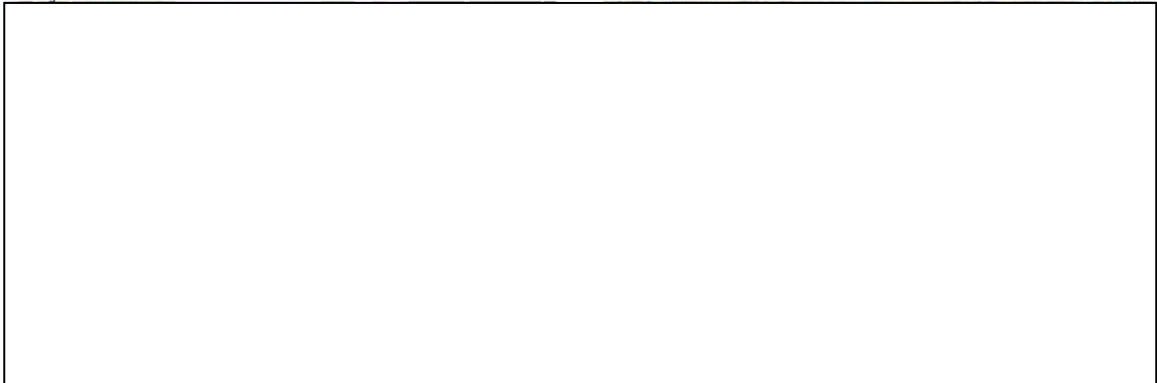
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Maine



Maryland

Massachusetts



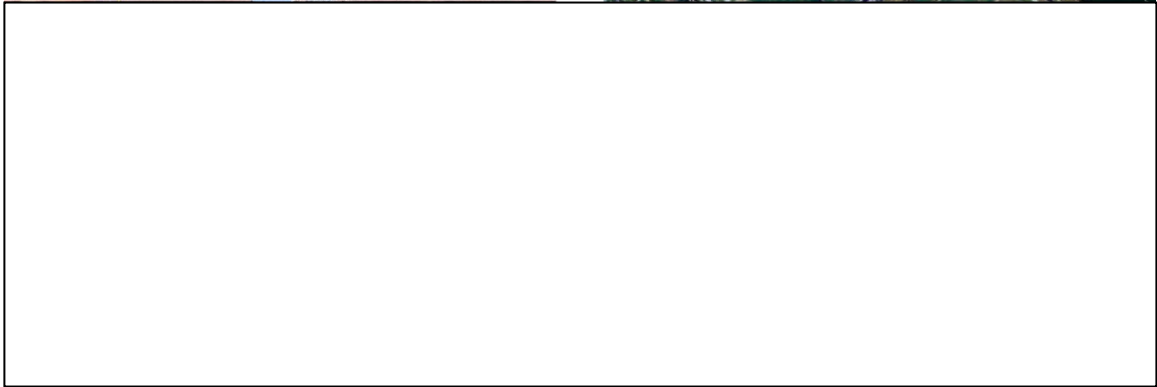
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Minnesota



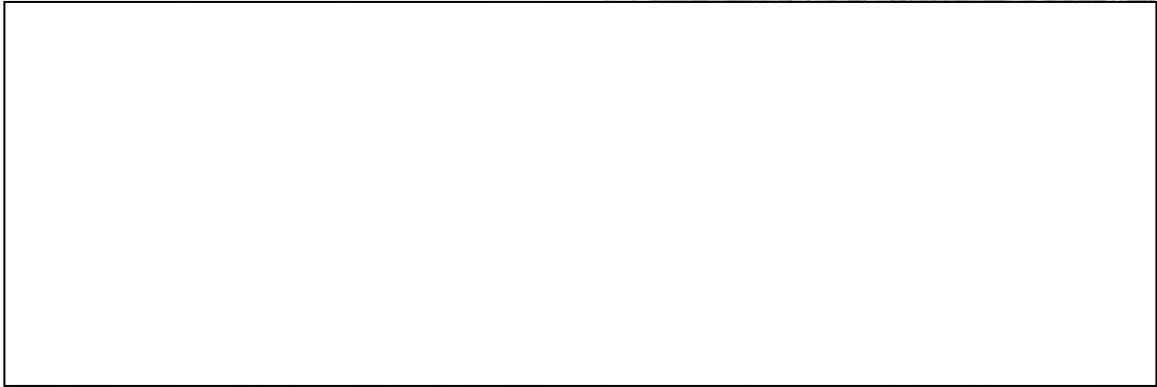
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Missouri



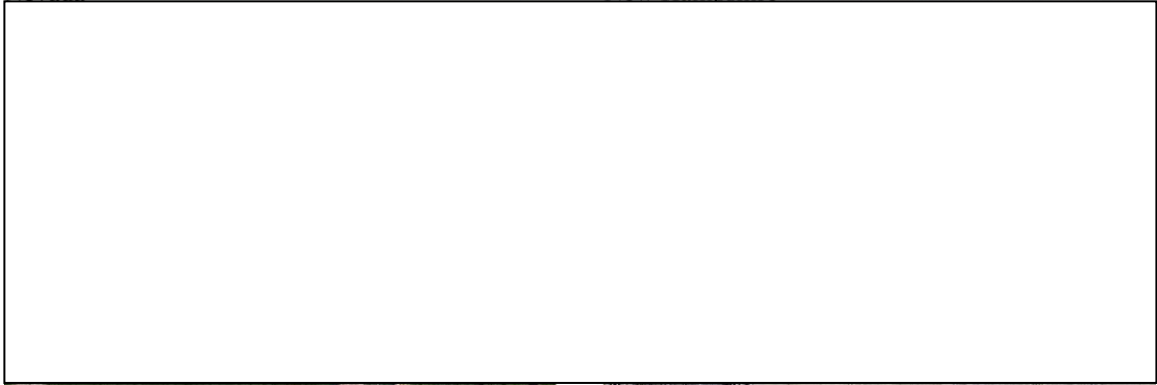
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Nebraska



Nevada

New Hampshire



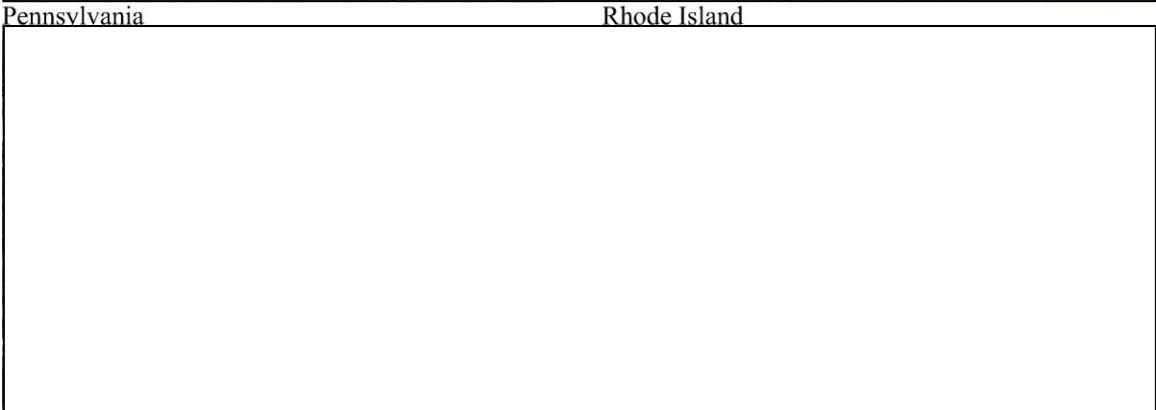
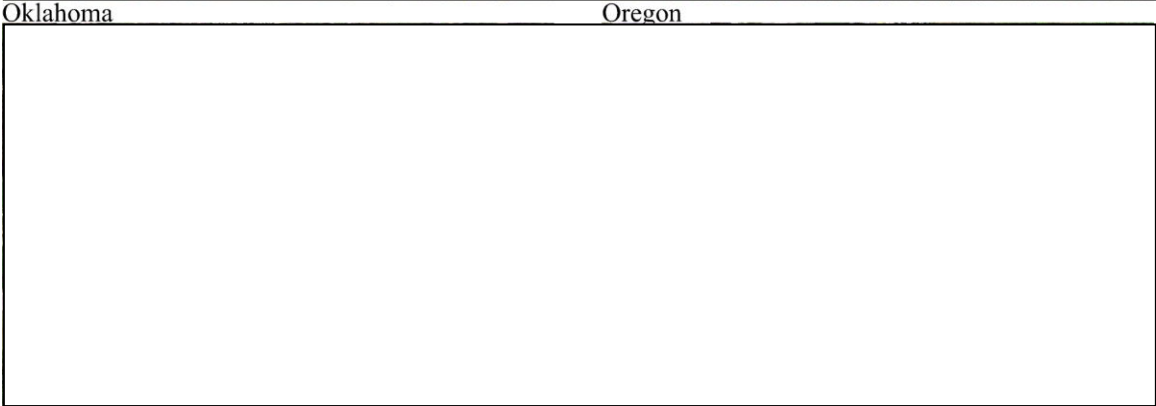
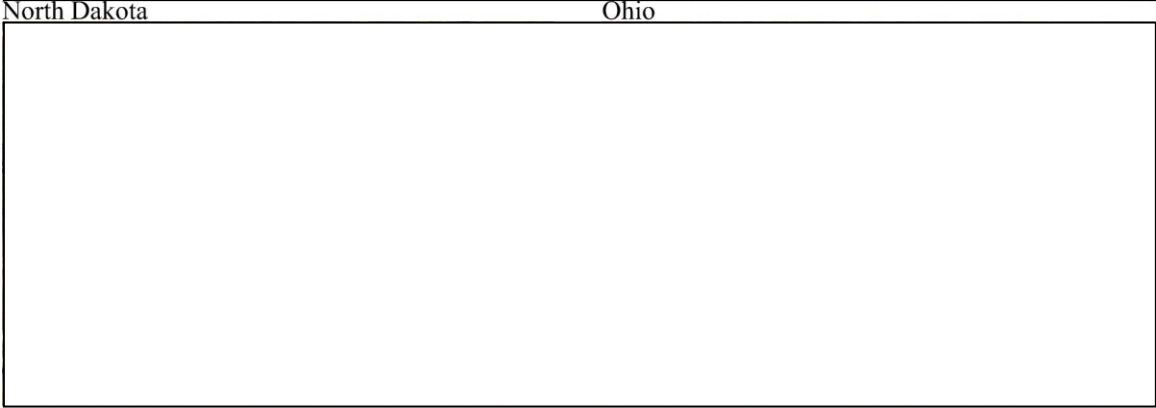
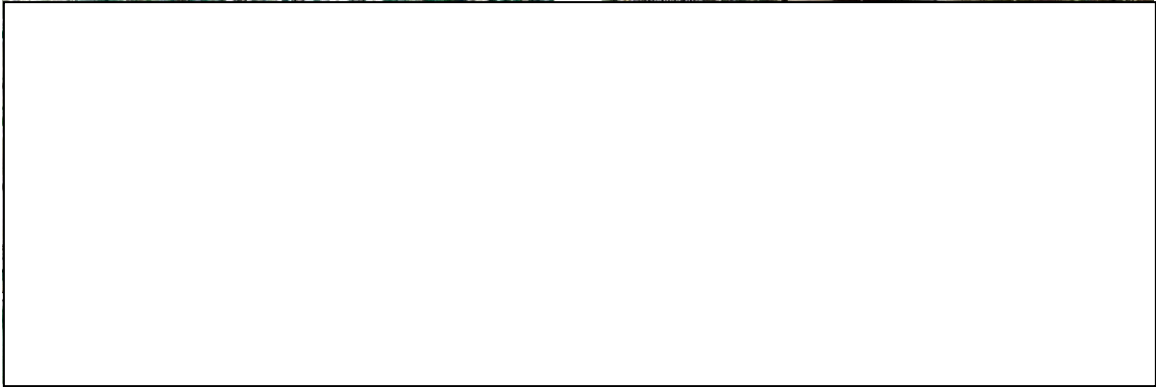
New Jersey

New Mexico



New York

North Carolina



North Dakota

Ohio

Oklahoma

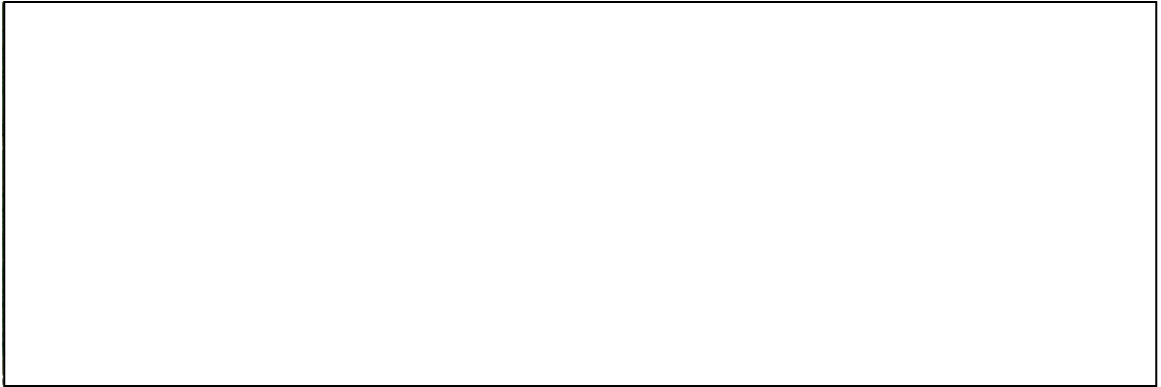
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Pennsylvania

Rhode Island

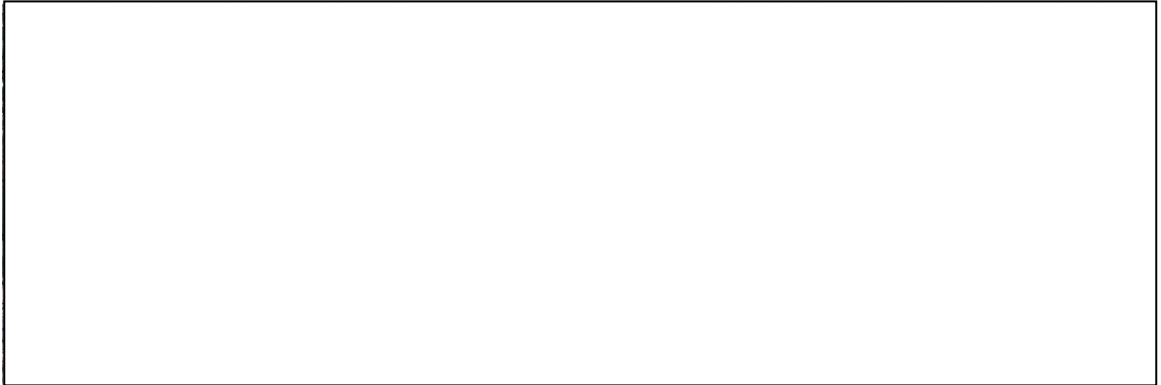
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South Dakota



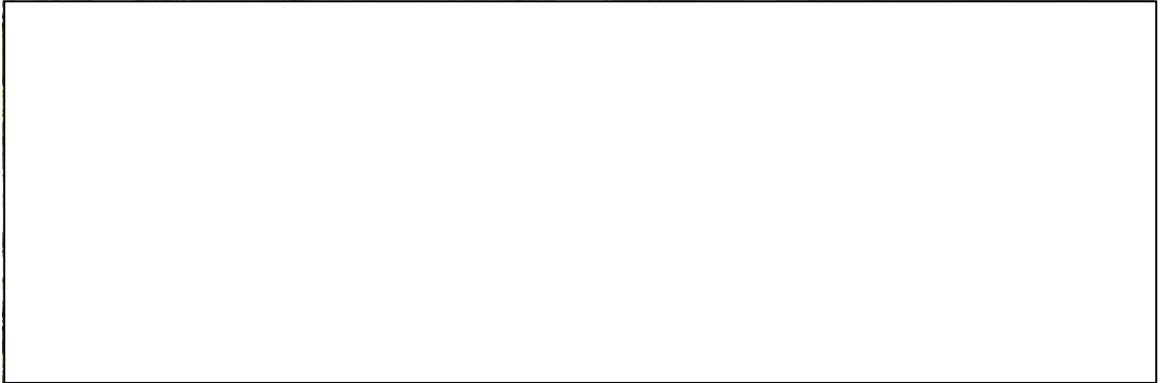
Tennessee

Texas



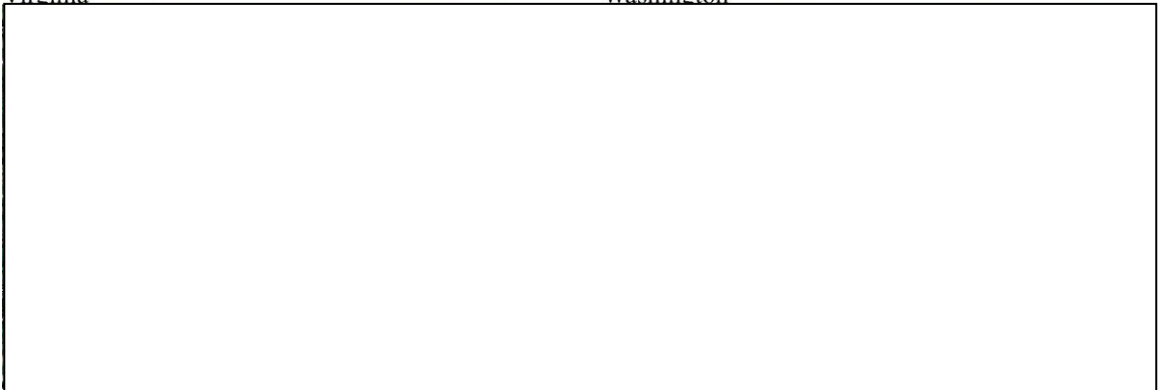
Utah

Vermont



Virginia

Washington



West Virginia

Wisconsin



Wyoming

Figure 6 - Mapping of U.S. Communities

With a specific look at the parks from Mississippi, Georgia, a segment of Michigan's, Kansas, and New York, a progression and variation in density and design can be seen. The organic and scattered organization of one community progresses to a rigid, tight grid through these five communities.

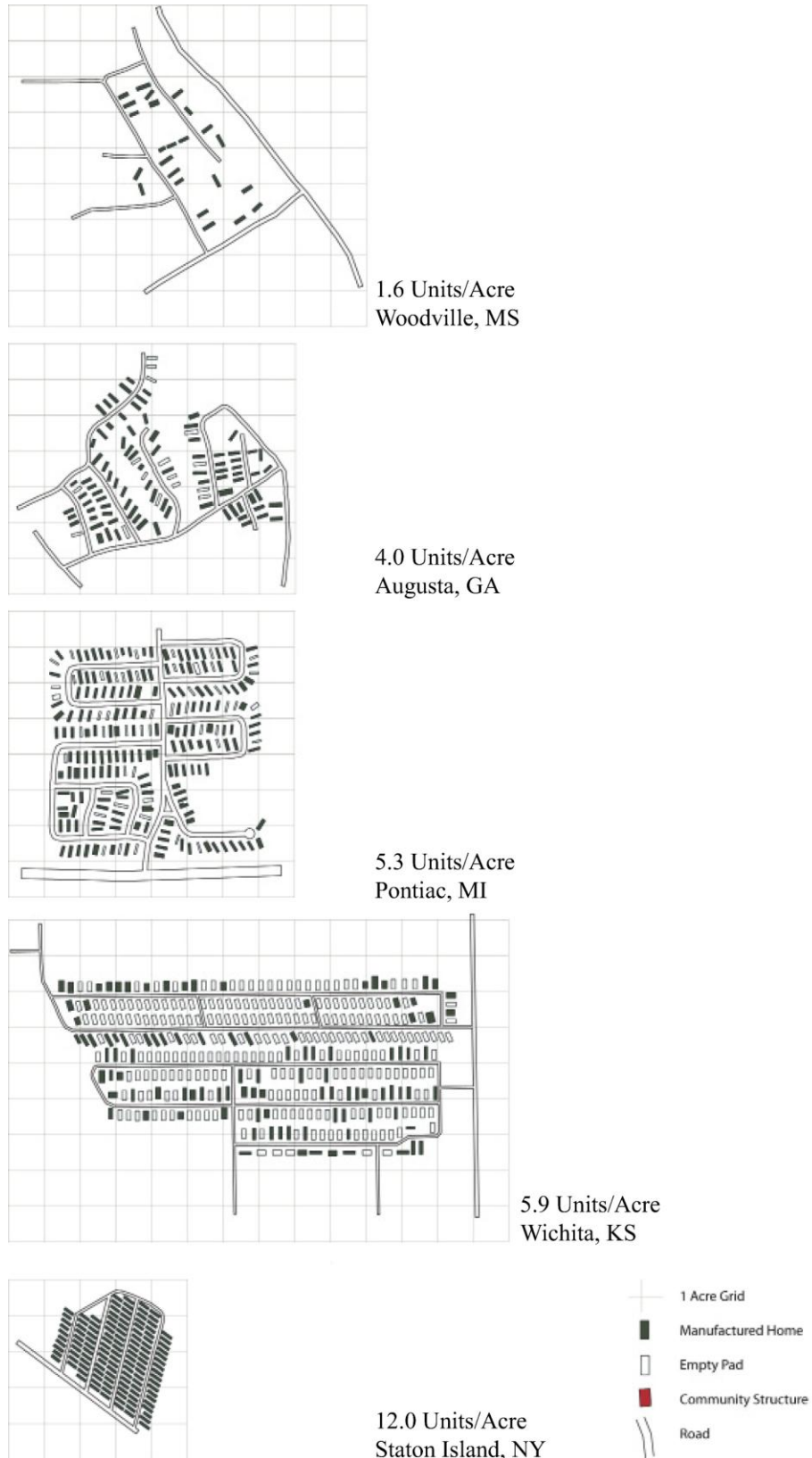


Figure 7 - Density Comparison

From these sites, a few conclusions can be drawn about general orientation of the structures as well as the design of the foundations. The layout of pads in a community influence how the spaces are used.

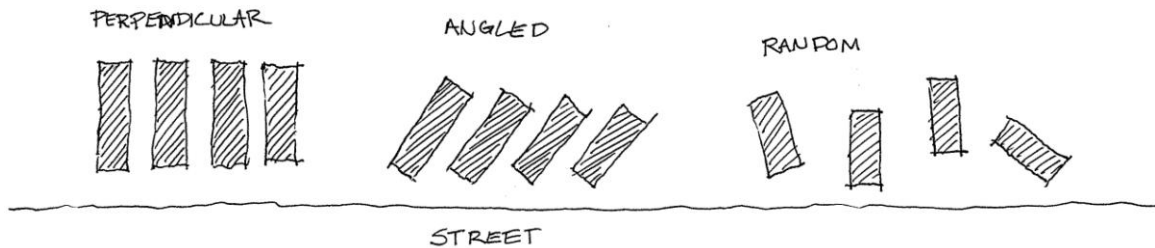


Figure 8 - Orientation of Structures

Most parks stick to the two layouts of perpendicular and angled homes to the street. A random organizational pattern appears in more rural landscapes.

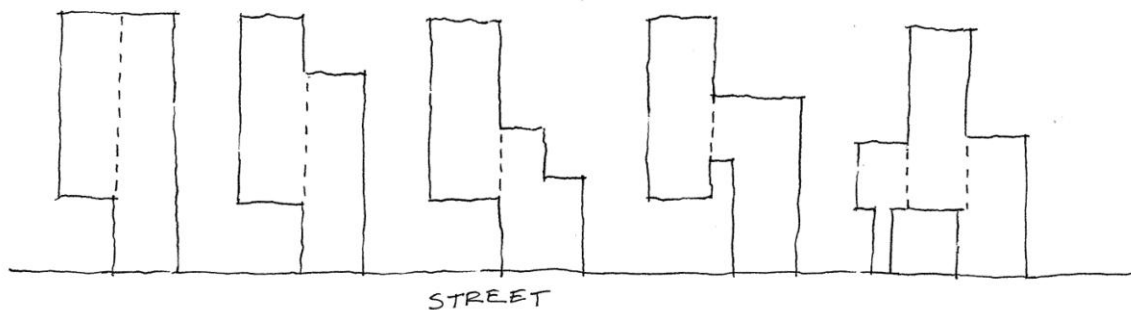


Figure 9 - Various Pad Layouts

The location of concrete pads for the homes designates where they will be sited. Giving additional space on a side, or creating a path to the street indicates an entry point, or an opportunity for a stoop or stairs.

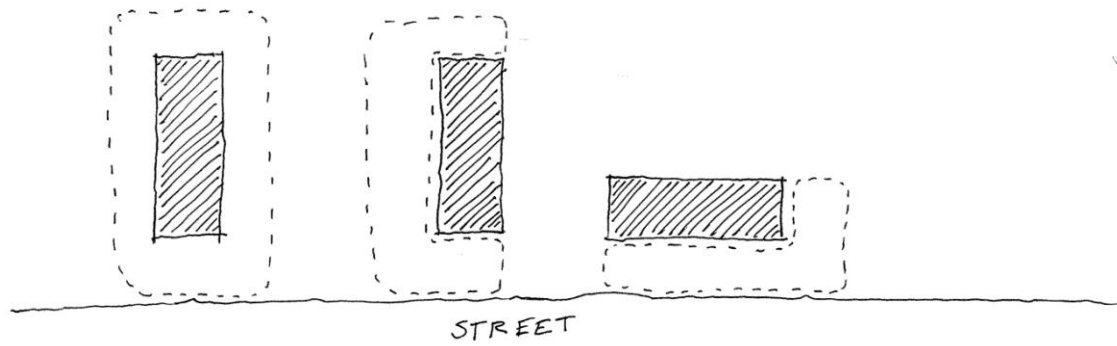


Figure 10 - Yard Areas

Yard shapes tend to mimic the long linear shape of the structures. Unless there is a common green space it appears that yards space is limited.

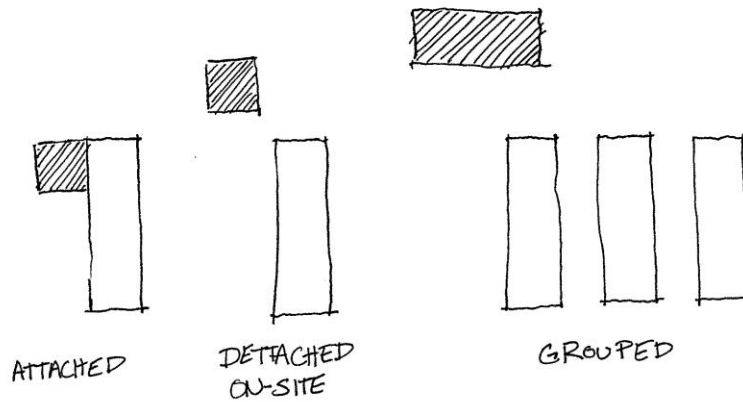


Figure 11 - Location of Storage

The majority of the communities surveyed use small storage buildings either attached or detached, while some communities have developed grouped storage for the units in an alternate location.

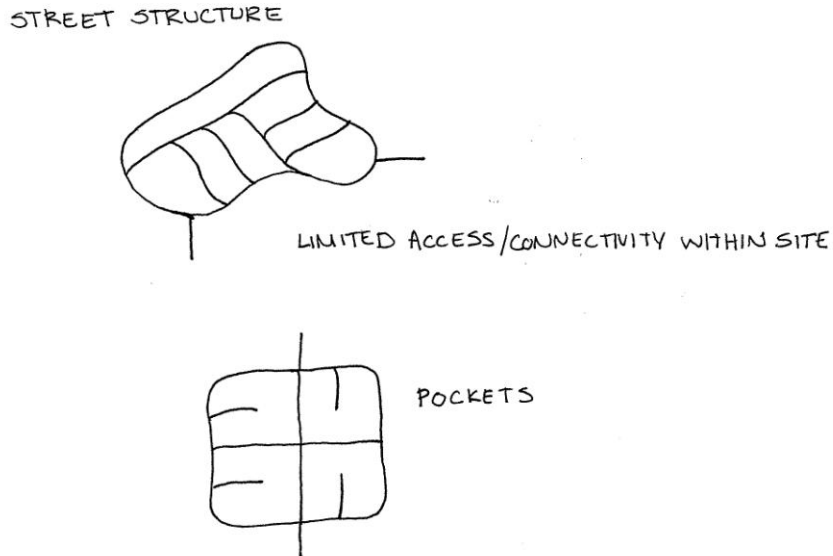


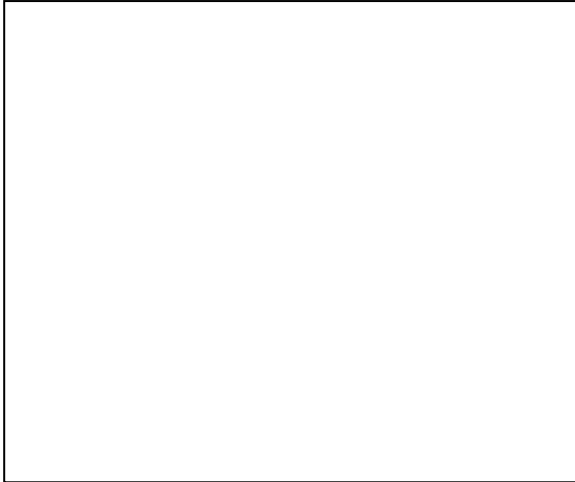
Figure 12 – Street Organization

Many parks hint at a grid, but these grids tend to connect back onto themselves; most communities have limited vehicular access points.

Manufactured Housing Institute – Communities of Distinction

The Manufactured Housing Institute, National Communities Council regularly designates outstanding parks as ‘Communities of Distinction’. This three-year designation requires an application followed by: physical property inspection, resident satisfaction survey, and manager educational training.⁵¹ Currently there are nine designees across six states. These communities are presented on the maps below:

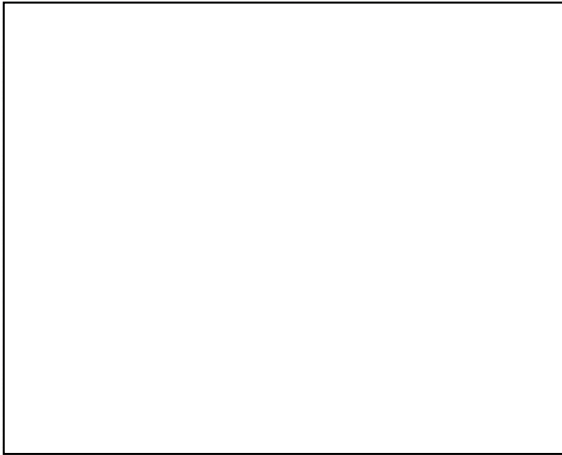
⁵¹ *Manufactured Home Communities, Distinction Program*. Manufactured Housing Institute National Communities Council. Web. 15 Jan. 2011.
<http://www.mhcommunities.org/cm/community_dist_program/default.asp>.



Childs Lake Estates, Milford, MI



5.7 Units/Acre



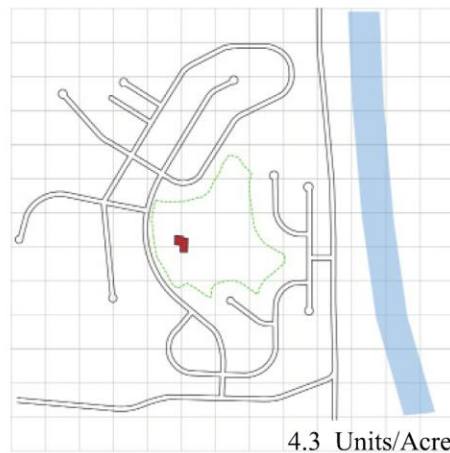
Princeton Crossing, West Chester, OH



6 Units/Acre

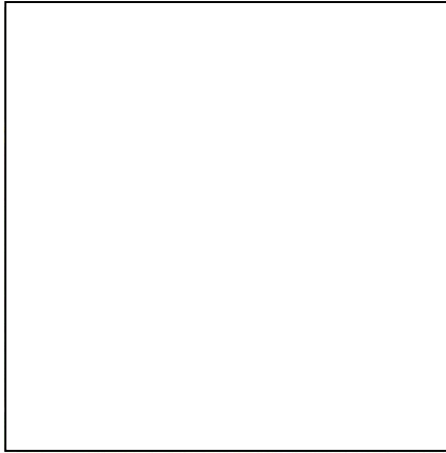


Riverview Crossing, Harrison, OH

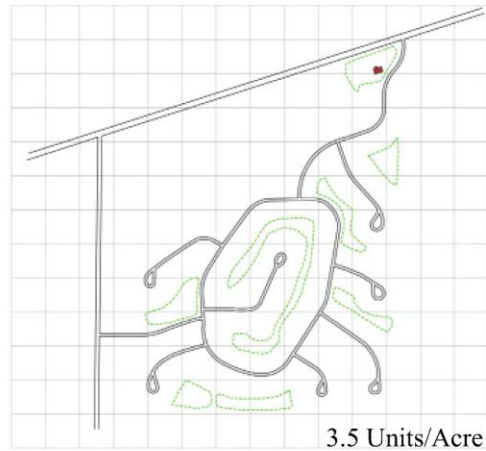


4.3 Units/Acre

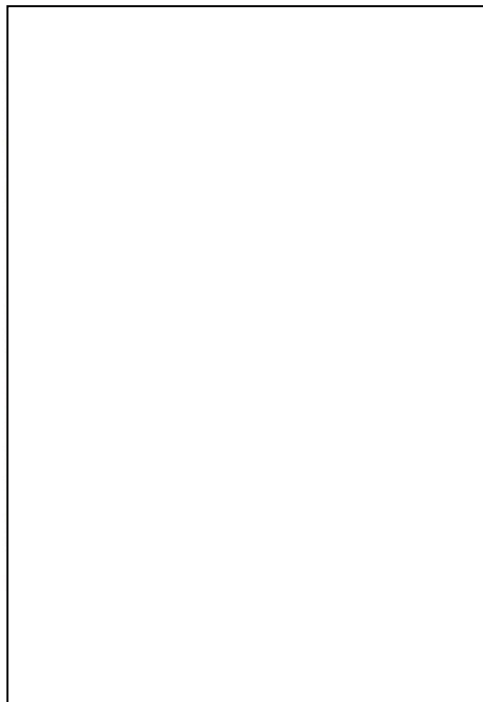
- + 1 Acre Grid
- Intermediate Green Space
- Community Structure
- Water Amenity
- || Road



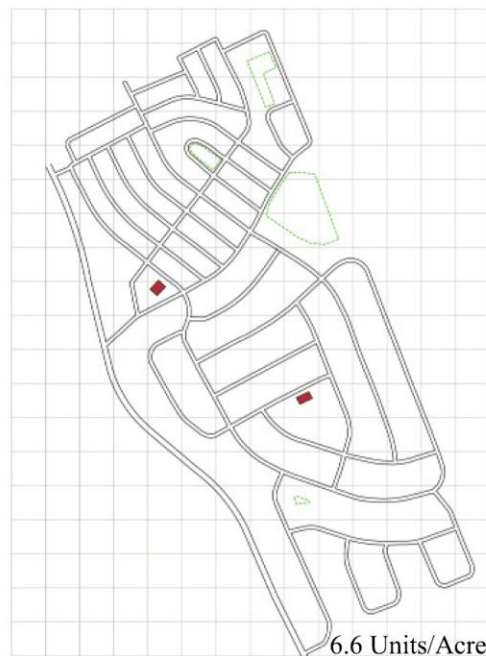
Troy Oaks Homes, Hiram, OH



3.5 Units/Acre



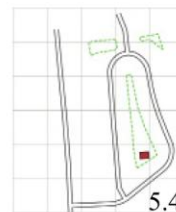
Peppermint Woods & Williams Estates, Baltimore, MD



6.6 Units/Acre

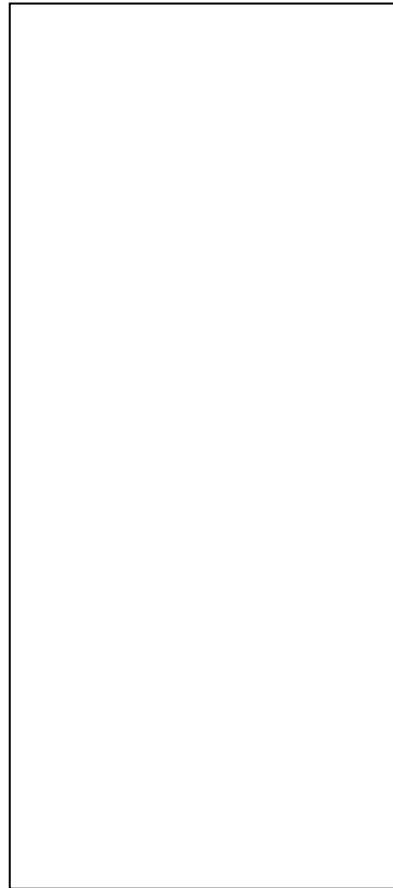


Lockwood Congress, Easton, PA



5.4 Units/Acre

- + 1 Acre Grid
- Intermediate Green Space
- Community Structure
- Water Amenity
- Road



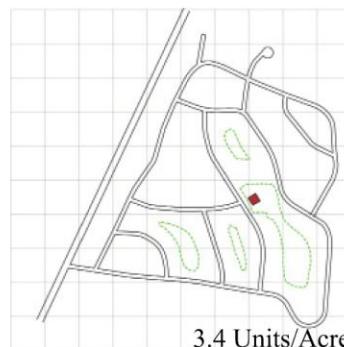
Tara Woods, N. Fort Meyers, FL



3.3 Units/Acre



Farmwood Village, Dover, NH



3.4 Units/Acre

- + 1 Acre Grid
- Intermediate Green Space
- Community Structure
- Water Amenity
- Road

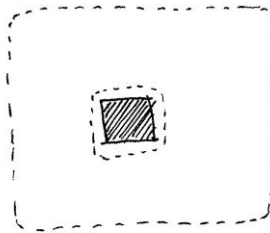
Figure 13 - Communities of Distinction

Among these nine sites there are many similarities in amenities which add to their success. Each has a community structure that provides amenities such a pool facility, a meeting space, recreation area, and more. There is also some intermediate green spaces; in some case this area may be designated park space, other is residual from the park design.

COMMUNITY STRUCTURE
-LOCATION WITHIN THE SITE



WELCOME CENTER SCENARIO



OASIS SCENARIO

Figure 14 - Community Space Organization Observation

The community structures tend to be situated in one of two ways, either at the front of a development or within the community. Princeton Crossing for example is a welcome center scenario with the community structure located near the neighborhood entrance. Childs Lake on the other hand has a nested community structure representing the oasis scenario.

Chapter 4: Site – A Case Study

Unlike many American vernacular housing types which can usually be found in specific areas, by virtue of its mobility manufactured housing has expanded into all regions of the country. Although the use of manufactured housing is more abundant in certain zones, it would be difficult to argue the type as more suitable to one region than another. From a historic standpoint, these homes were mobile and could be sited almost anywhere across the country. This historic connection to transportation presents an interesting opportunity to make a physical connection to modes of transportation and community nodes.

The site selection for this case study will represent a network of sites across the country that in theory would allow homeowners to move and connect into the network of various U.S. cities.

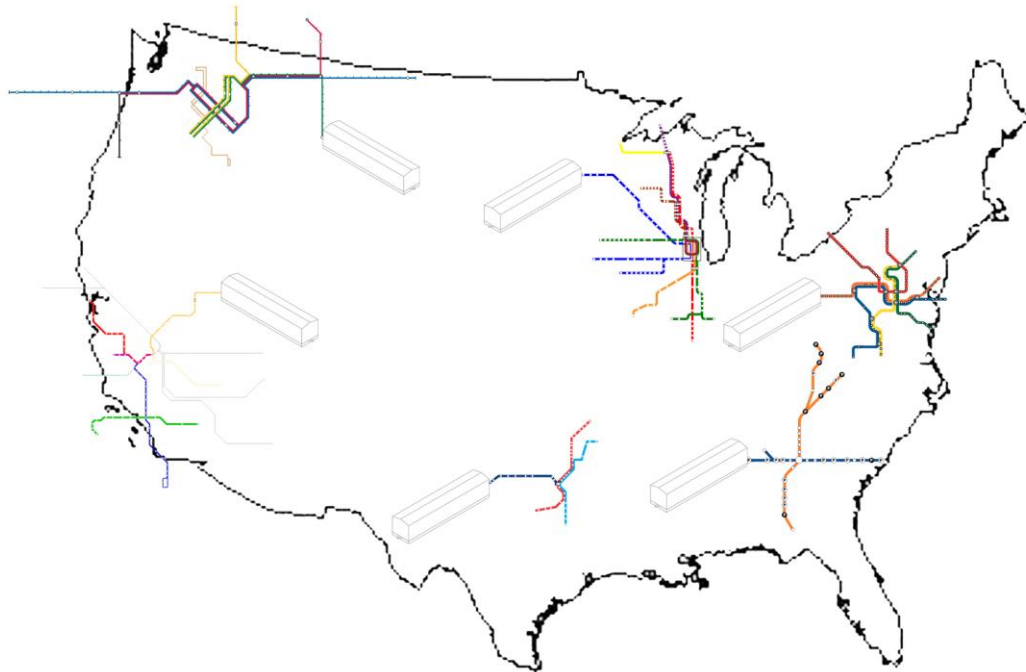


Figure 15 – Connective Theory Diagram

Climate

In addition to being structurally able to support wind loads during transportation, manufactured housing must meet building codes based on wind, snow loads, and temperature. Homes are designed to meet the code in the location of where they will be initially installed. Should a home be designed for a lower wind zone, lighter snow load, or more moderate temperatures, that home may not be moved into zones with higher requirements. It is possible for a home designed for more severe conditions to be moved to a more moderate climate. The wall and roof structure and especially a system of tie-downs are important to design with these climate restrictions in mind. These three climate zones can be seen in the following figures:

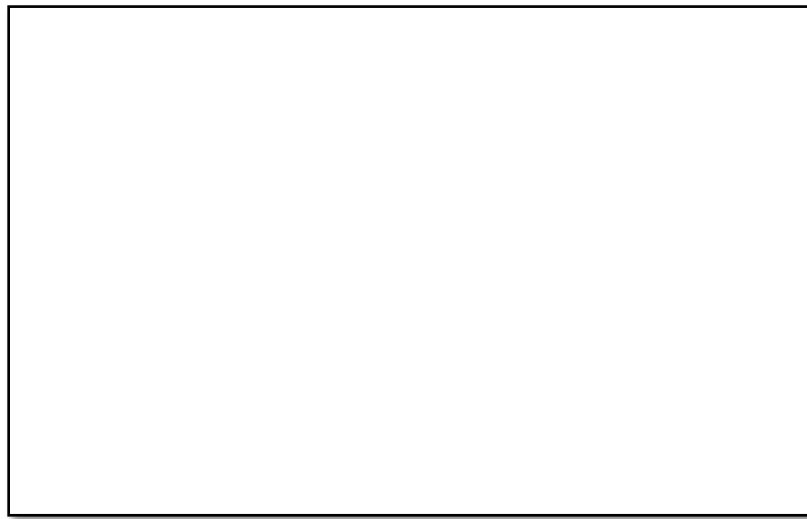


Figure 16 - Wind Zones⁵²

⁵² *Building Codes and Standards Resources*. Manufactured Housing Institute. Web. 15 Jan. 2011. <http://www.factorybuilthousing.com/technical_resources/>.

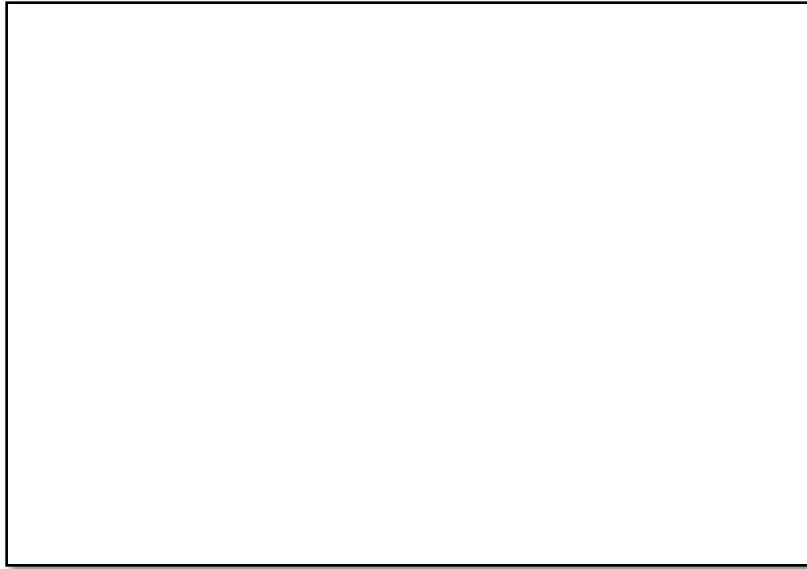


Figure 17 - Roof Load Zones⁵³

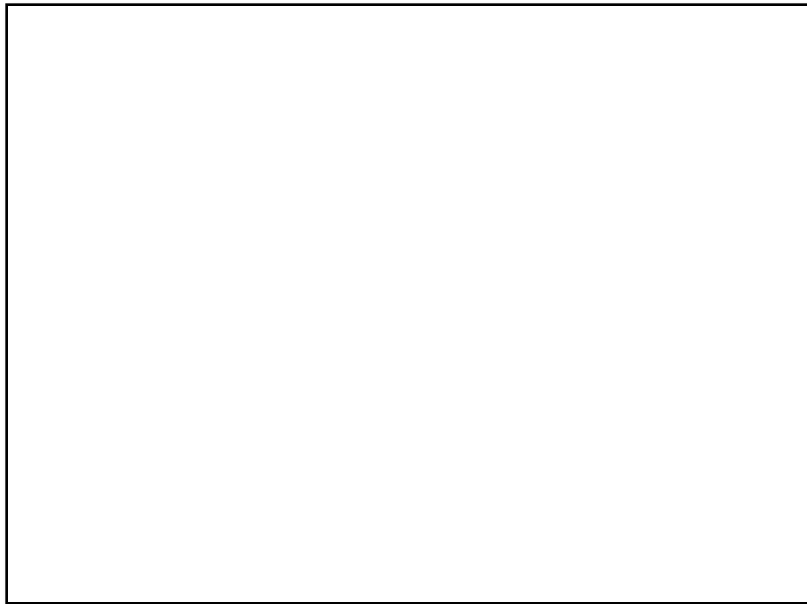


Figure 18 - Thermal Zones⁵⁴

⁵³ *Building Codes and Standards Resources.*

⁵⁴ *Building Codes and Standards Resources.*

Density

Consideration of housing density becomes more important every day with the growth of suburban areas. As the population grows, people spread farther from cities to live in a free standing, single family home. By 2030 the country will need to build more than half of the number of homes existing today to house the population.⁵⁵ The range of densities between rural and urban settings can be very large; rural densities tend to be less than one unit per acre while urban areas can reach hundreds of units per acre. At six units per acre public transportation becomes viable.⁵⁶

Progression of size in manufactured homes since the late 1950's has followed in step with conventional site built homes. Site built homes in the 1950's had an average square footage of about 1,100 square feet, while by they averaged about 2,340 square feet.⁵⁷ Below is a comparison of manufactured homes in the 1950's and 2000's to site built homes, one on each quarter acre lot. From packing the homes more tightly into the acre lot it appears that manufactured housing can accommodate twice the density as site built homes.

⁵⁵ Campoli, Julie, and Alex S. MacLean. *Visualizing Density*. Cambridge, MA: Lincoln Institute of Land Policy, 2007. P. 5

⁵⁶ Campoli p. 15

⁵⁷ Campoli p. 38

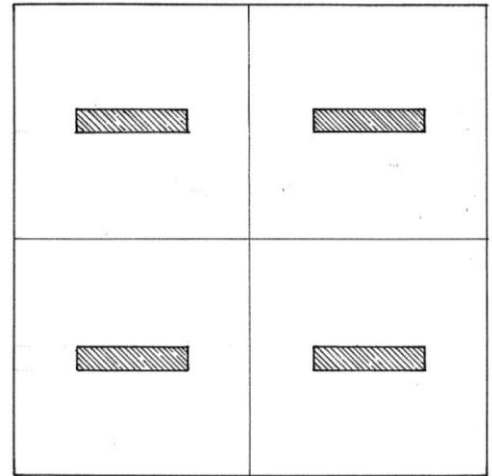
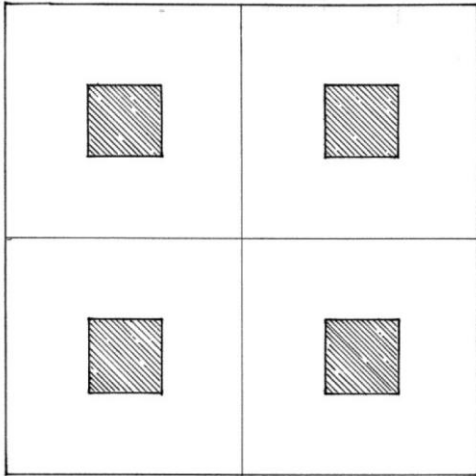


Figure 19 - 1950's Site-built (Left) vs. Manufactured Homes (Right) Footprints

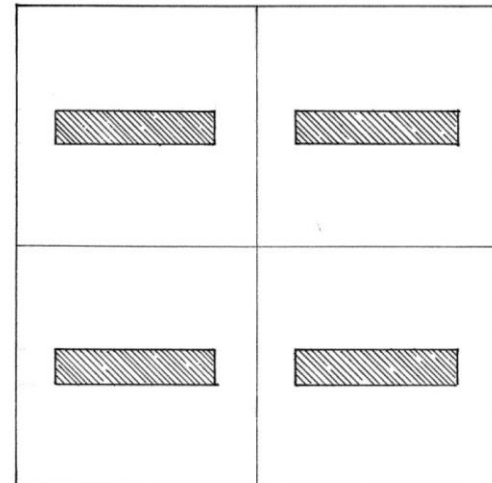
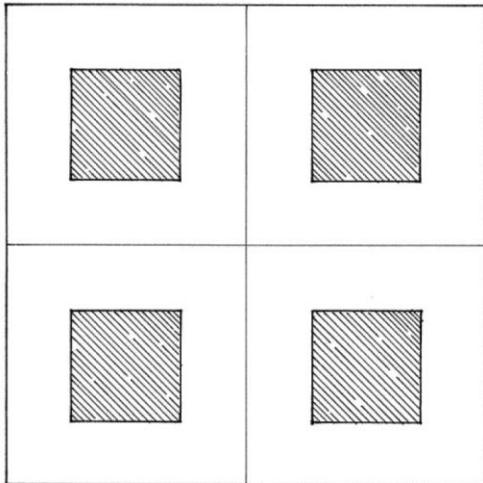


Figure 20 - 2000's Site-built (Left) vs. Manufactured Homes (Right) Footprints

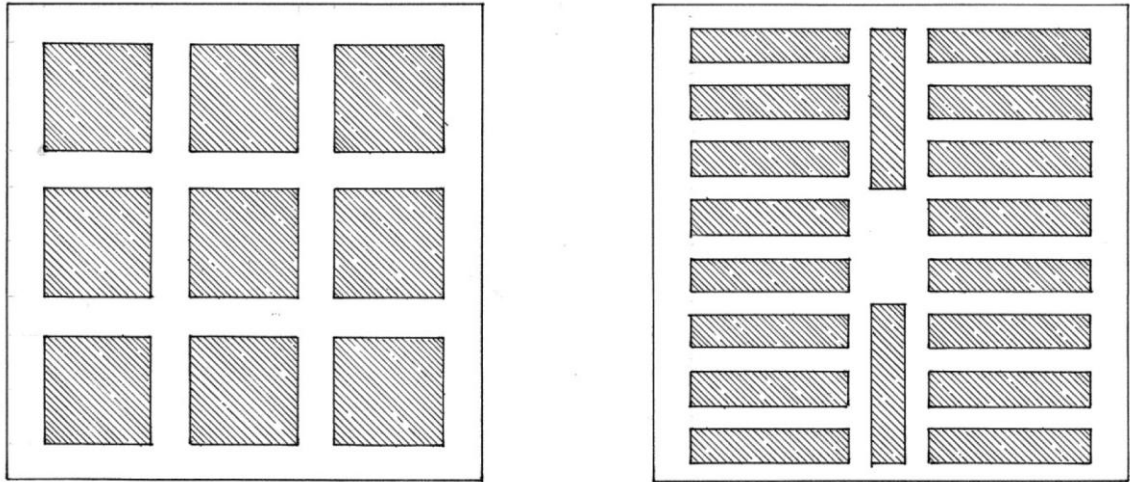


Figure 21 – 2000's Site-built (Left) vs. Manufactured Homes (Right) Density Comparison

Ranging in size from three units to one thousand, manufactured home communities accommodate various scales of living. Between eighty and eighty-five percent of communities have one hundred or less units; the remaining fifteen to twenty percent have over one hundred and are sometimes considered “institutional investment-grade” communities.⁵⁸ At fifty units and above, ordered design of parks becomes more prominent; between thirty and one hundred units the economic advantages of density appear in the form of resident managers and guards.⁵⁹ In an effort to create communities across the country as connection points to larger cities, the size must be kept relatively small to be sited closer to cities.

In an effort to determine an adequate site for a higher density community design, placing one hundred average sized (2008 standards) manufactured homes sited on 12 acres provides a starting point. One hundred homes on 12 acres yield a density of 8.33 units per acre. To factor in space for recreational activities and amenities, a site of

⁵⁸ NAHB p. 21

⁵⁹ Hart p. 77

around 15 acres provides more breathing room and still keeping the density above six units per acre.

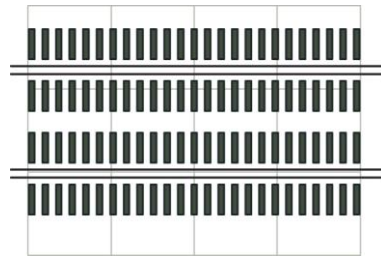
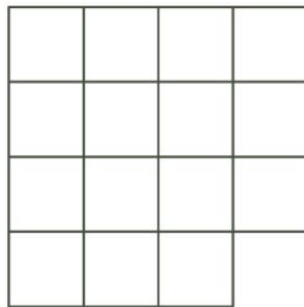
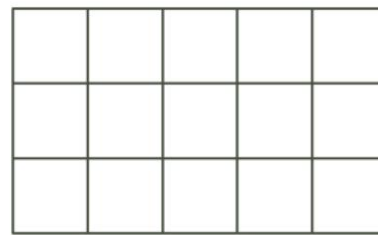


Figure 22 – 15 Acre Density Analysis

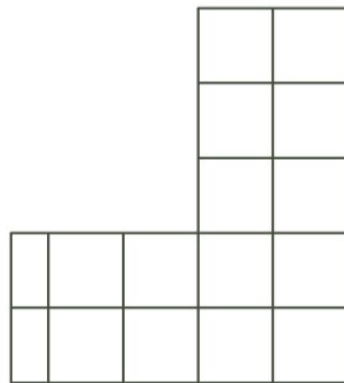
Based on the 15 acre number, there are countless forms this size site could take such as:



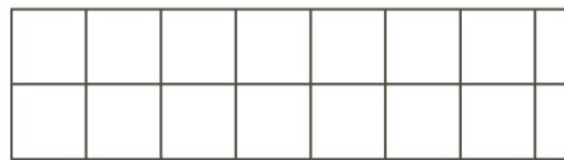
Square



Rectangle



Angle/Corner



Linear

Figure 23 - Site Shape Possibilities (15 acres)

An initial look at possible site shapes and strategies for those shapes begins may influence site design at a later time.

Within a development there should be an obvious hierarchy of function and organization.

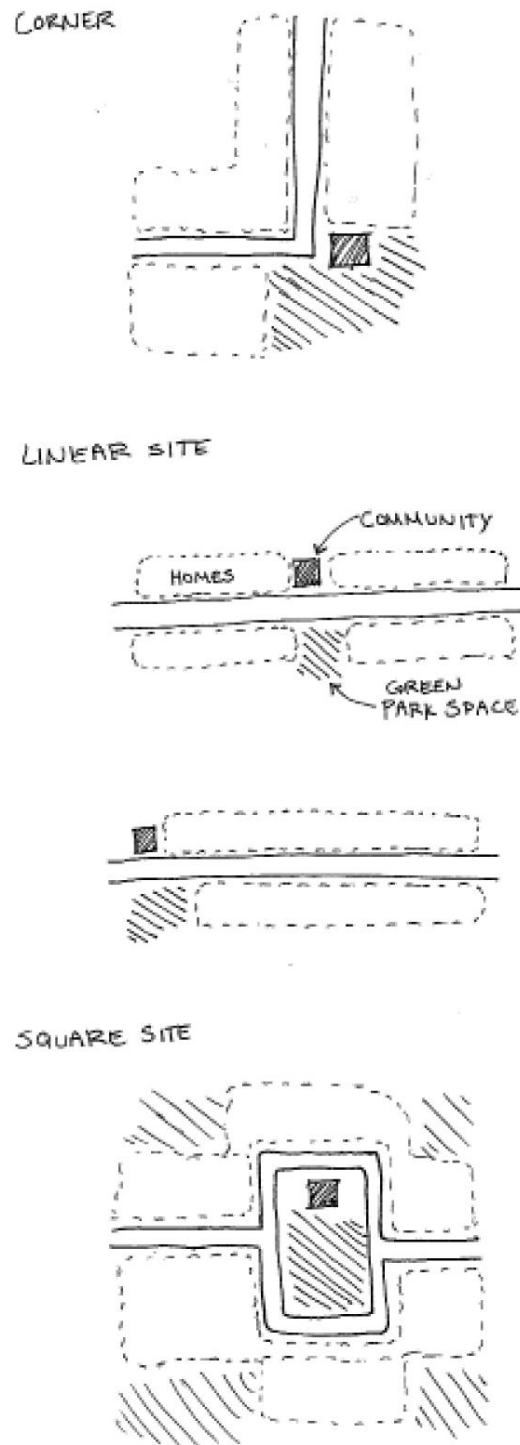


Figure 24 - Community Space Location Strategies

Chapter 5: Design Proposal

Information gathered from the history and current practices of the manufactured housing industry can be used as a loose framework for improving home and community design. HUD regulations control design of manufactured housing; with the ability of moving to multiple climate zones in the country, the extremes must be considered.

The Home

To design a smaller home, more conducive to travel, requirements (minimums) set by building codes are as follows.

- Living Space – 150+ sq.ft.
- Bedroom – 50+ sq.ft. – 1 person
 - o 70+ sq.ft. – 2 people
 - o Closet with depth of 22”
- Hallways – 28”+
- 2 Means of Egress – not less than 12’ center to center apart
- Ceiling heights – 7’+ for 50% of a room’s floor area
- No dimensions may be less than 5 feet.⁶⁰

The design of this home is intended to promote transportation and to appeal to demographics that wish to connect to cities; taking the idea of a small affordable studio and creating a mobile housing unit. Minimum programmatic elements for this home:

- 1 Bedroom
- 1 Living Space

⁶⁰ "2001 CFR Title 24, Volume 5." *U.S. Government Printing Office Home Page*. Web. 15 Jan. 2011. <http://www.access.gpo.gov/nara/cfr/waisidx_01/24cfr3280_01.html>.

- 1 Bathroom
- 1 Kitchen

For structural reasons, openings in walls must be carefully designed to withstand the stresses of transportation. Because of this often time the shorter side of a home will have no openings, or on occasion one. As most communities orient their homes with the short side towards the street, the blank wall faces the street, taking away character and diversity.

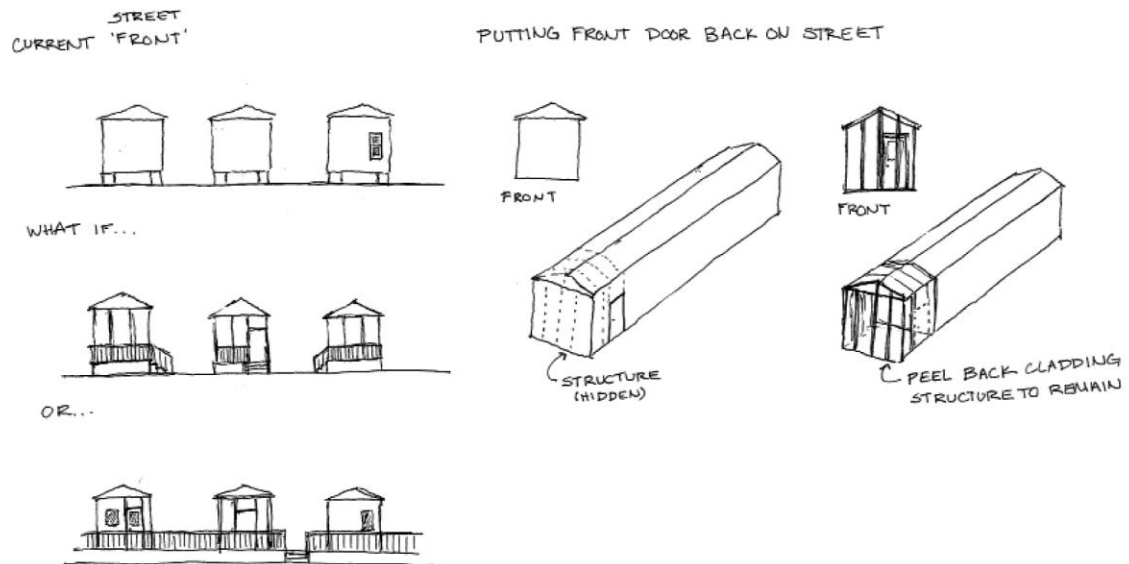


Figure 25 - Home Design Strategies

Taking a closer look at Federal Highway Administration standards for transportation led to a decision on how to limit the design scope of the home. In a study of standard truck and trailer dimensions, the damage to highway systems due to off tracking (driving off designated areas during turns), is less when the trailers are short. The turning radii can be tighter and thus cause less damage to road shoulders.⁶¹ Trucks towing two or three 28' or two 33' trailers can be considered advantageous to the

⁶¹ *Chapter VII: Roadway Geometry*. Rep. Federal Highway Administration. Web. 15 Jan. 2011. <<http://www.fhwa.dot.gov/reports/tswstudy/Vol3-Chapter7.pdf>>.

country's infrastructure. As seen in Figure 26, dimensions of what is considered the STAA Double require no extra cost for oversized loads in any state.

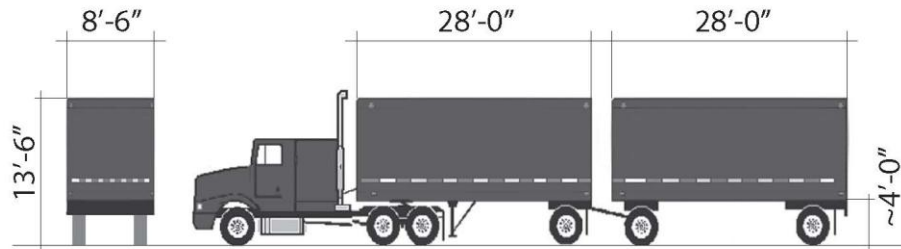


Figure 26 - STAA Double Dimensions

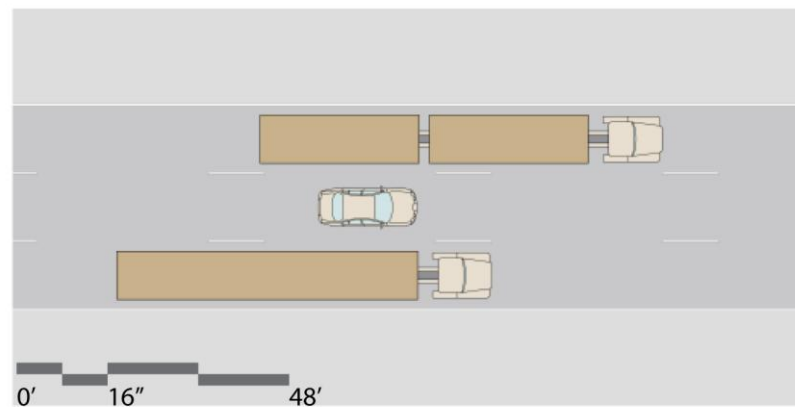


Figure 27 - Road Dimension Diagram

By using this module as a starting point for home design, the restricted size will potentially bring affordability to the moving process.

Limited by the size of transportation dimensions, the design challenge became how to arrange the two segments. Simply putting the sections side by side to create a larger space does not create new spatial opportunities. Shifting and turning the sections begins to define exterior space and offer a variety of floor plans. Within the variations of floor plans each has an amenity different than the other.



Figure 28 - 'L' House Design



Figure 29 - 'T' House Design

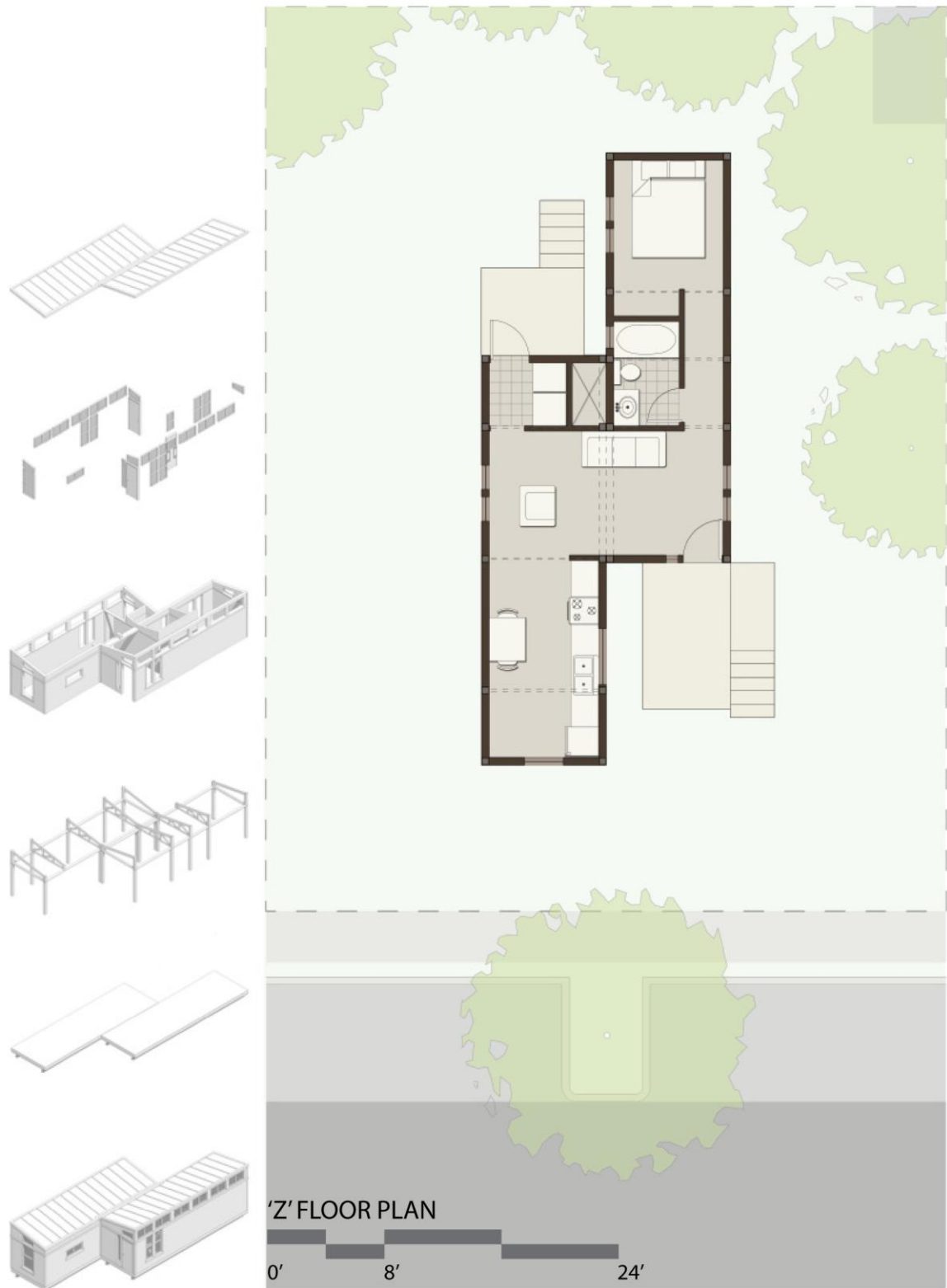


Figure 30 - 'Z' House Design

- The 'L' plan offers a large defined back exterior space
- The 'T' plan offers a second small bedroom, study, or laundry space and larger defined front and back exterior space
- The 'Z' plan offers a larger central living space as well as small defined front and back exterior space

Each home requires a porch and step system due being raised above the ground.

Dimensions of the porch segments are kept to a 6' width and the longest dimension 10'.

This allows homeowners to transport these segments on a trailer for a personal vehicle.

Moving from the floor plans into three dimensions, the vertical characteristics become critical in creating a livable space. Proportions of a space can drastically affect the feeling of comfort. Interior heights of the units can go little above 9' on the interior due to height restrictions during transport. Figure 31 explores the proportions of heights with a flat roof.

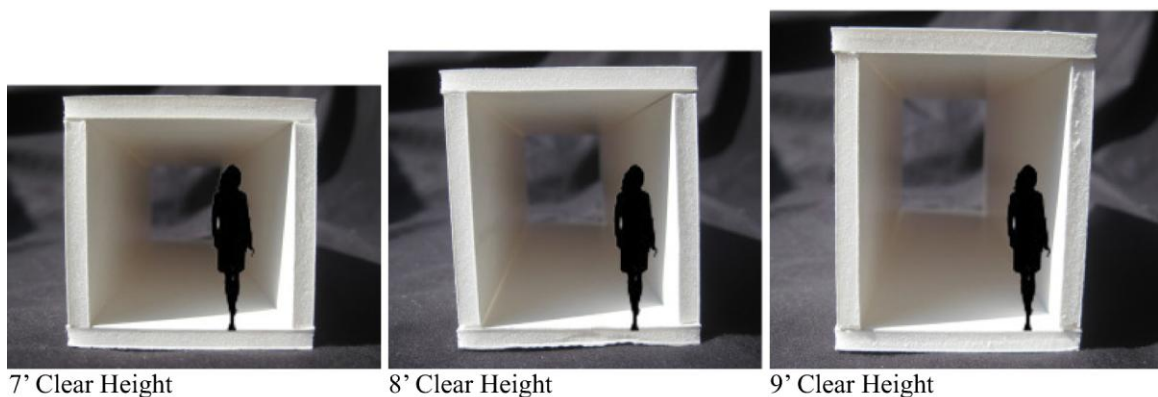


Figure 31 - Height Proportion Analysis

As the space becomes elongated vertically, there is an emphasis on how the narrowness of the unit. Although the 7' space seems low for an average height person, the proportions give the illusion of a wider space. Consideration of a datum line at the 7'

height could provide the horizontality needed for a taller space. Further consideration for visual privacy, day-lighting and water management begins to inform the roof pitch and window placement, see Figure 32.

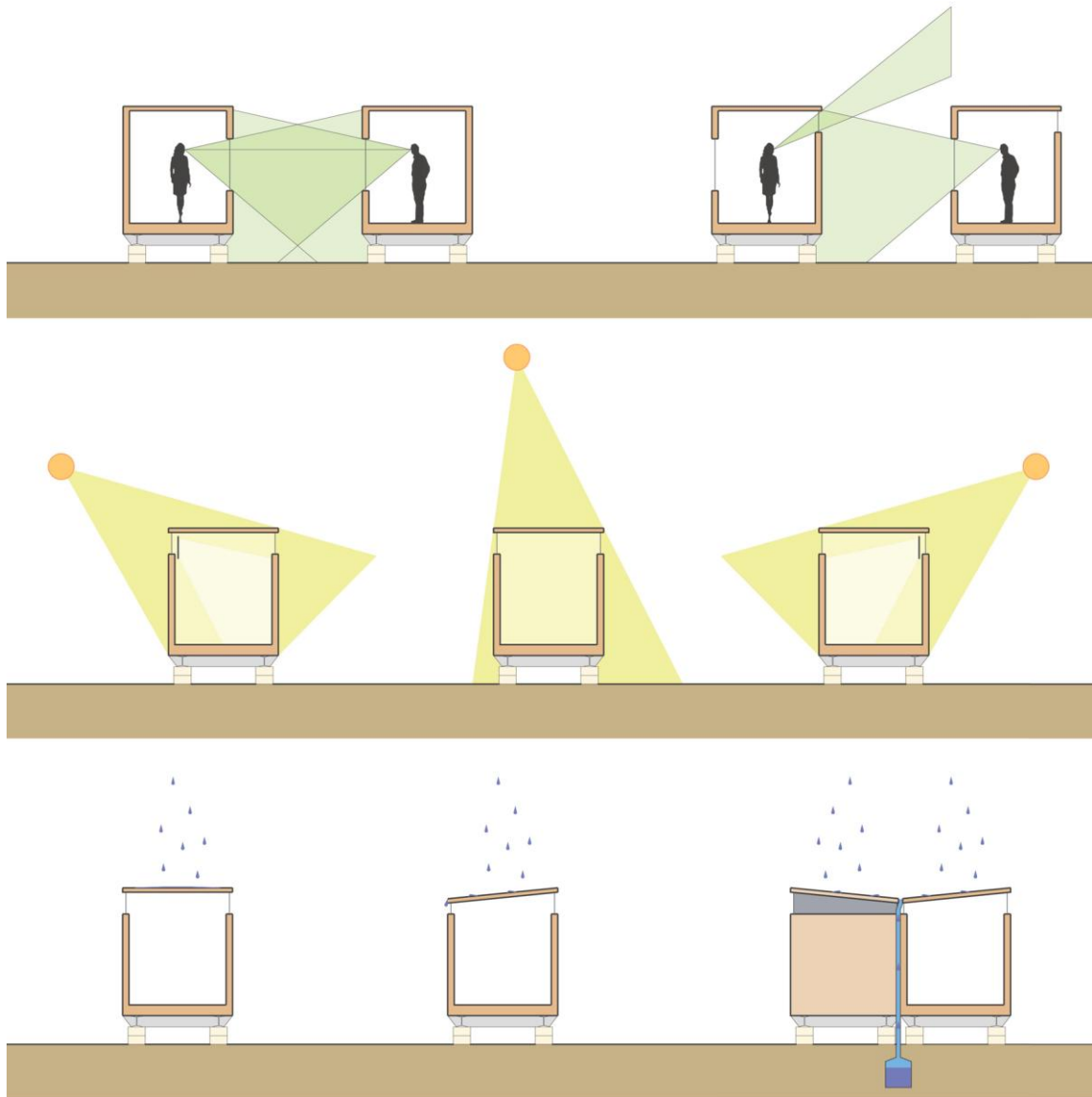


Figure 32 - Sectional Design Approach Diagrams

Application of the sectional ideas of sight, light, water and the proportional ideas to the scale of the three floor plans can be seen in model form in Figure 33.

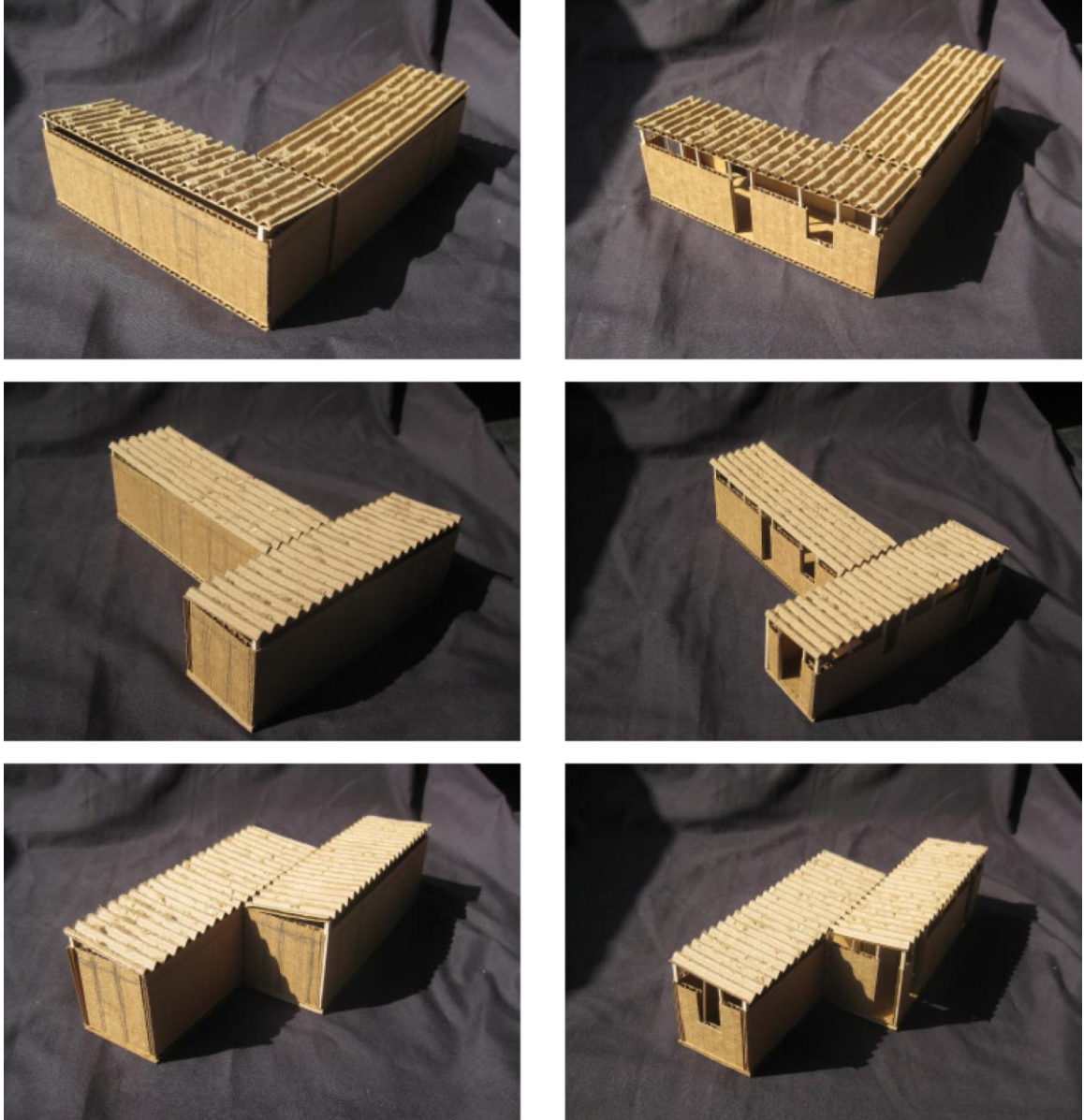


Figure 33 - Model Studies

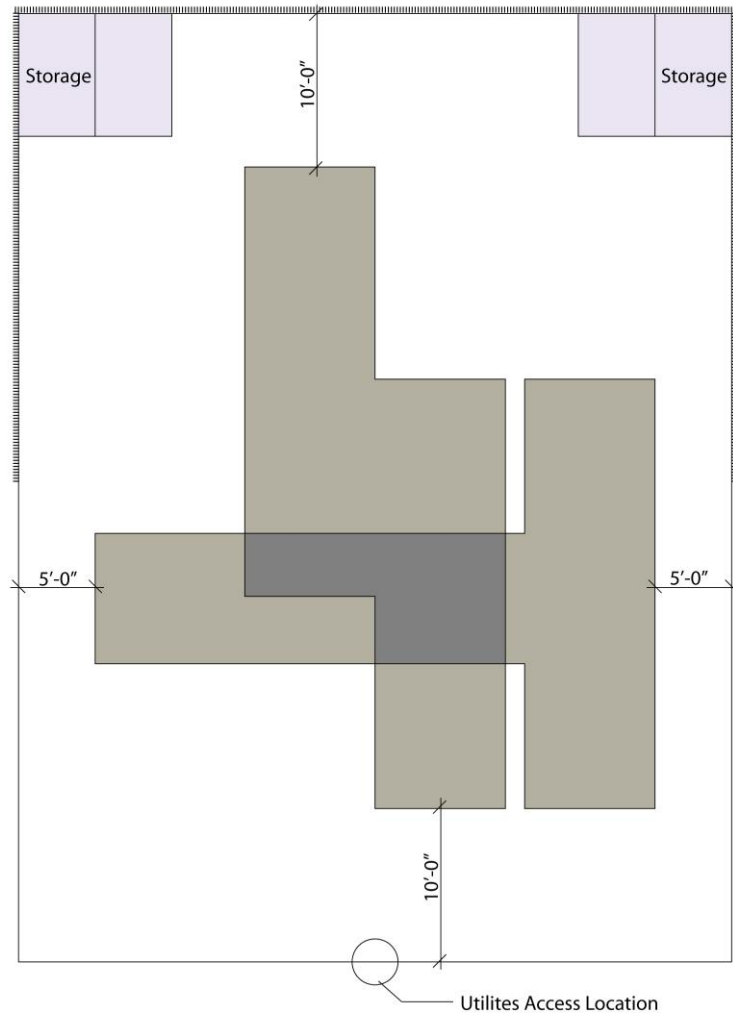
The design of all three prototypes relies on the relationship between interior and exterior space as well as inter-unit relationships. Immediate surroundings become important to the comfort of the home design.



Figure 34 - Interior Perspectives

Lot Design

With the intent of aggregating these homes to create a community, a specified lot dimension and design can define the private space of the unit as well as bring a cohesive organization to the community. Using the longest dimensions of the units, which are the width of the 'T' plan and the length of the 'Z' plan, setbacks designate lot size.



LOT DIAGRAM



Figure 35 - Lot Design Diagram

Components of the lot include:

- Storage Units – Provided by the community to be located at rear corners
- Fences – Provided by the community, can extend permanently half the distance of the lot
- Utilities – Access point at front center of lot, to be extended at home installation

To retain the ability to move homes easily from the site, tree placement needs to be planned. Based on the turning radii of the truck, a portion of the front area of the site will need to remain clear for home installation. Areas open for planting become designated to the rear of the lot and edges as well as a front, central planter at the street.



Figure 36 - Site Design and Truck Access

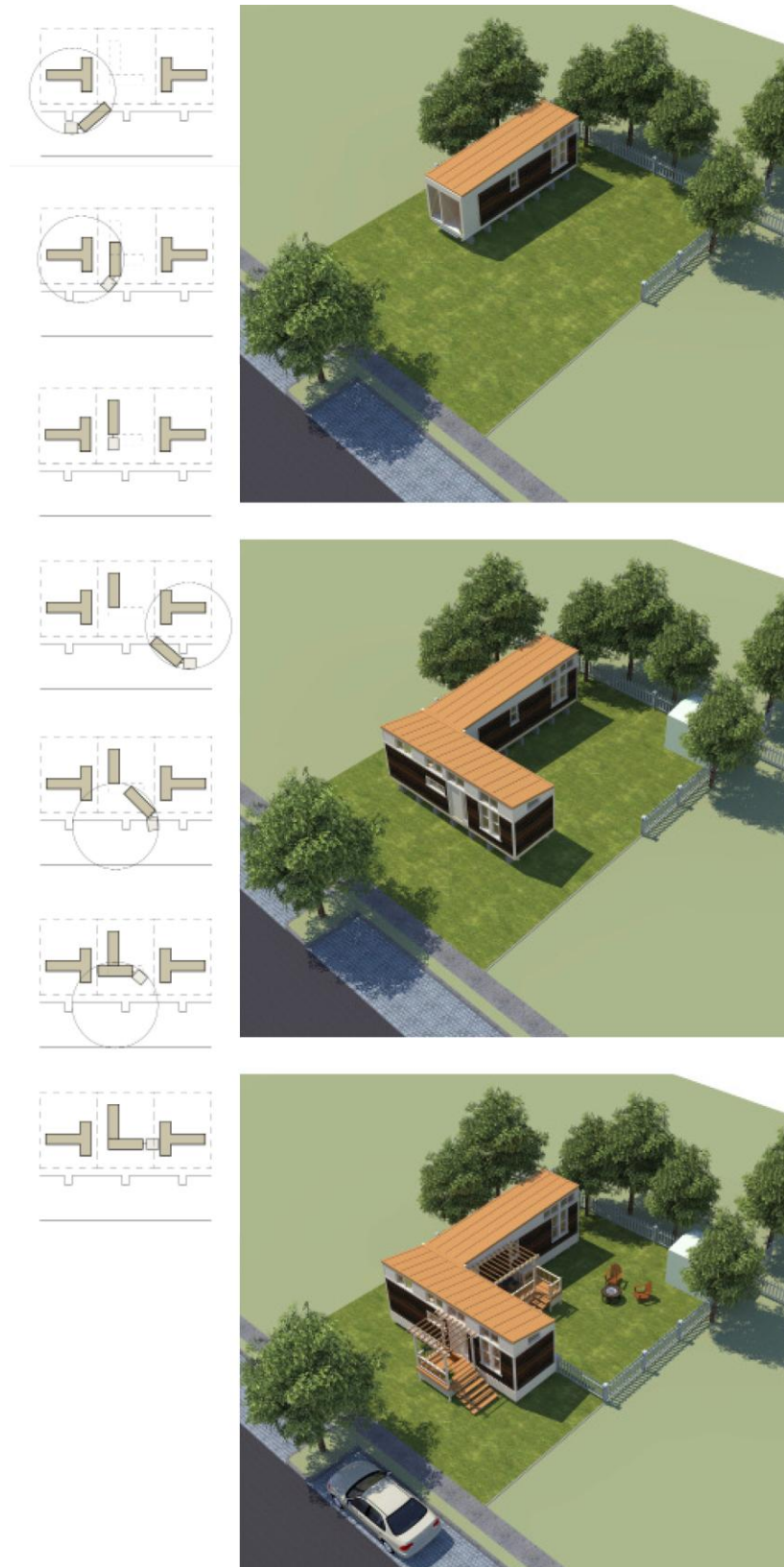


Figure 37 - 'L' Home Installation

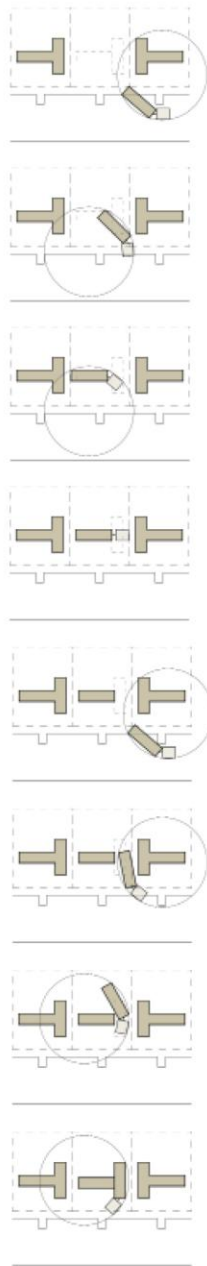


Figure 38 - 'T' Home Installation

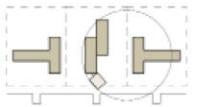
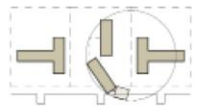
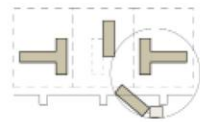
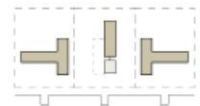
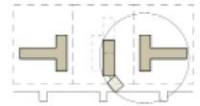
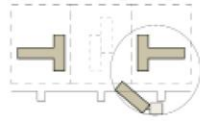


Figure 39 - 'Z' Home Installation

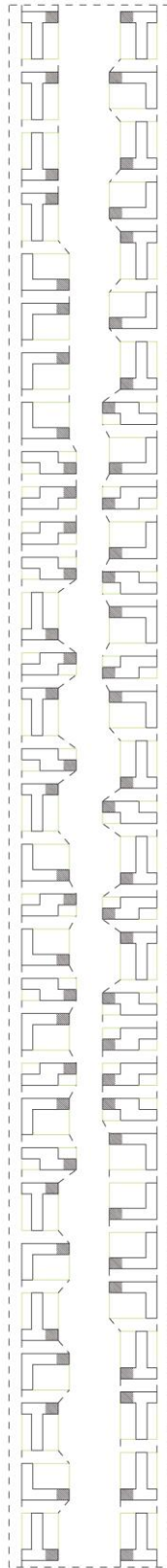


Figure 40 - Unit Relationship Diagram and Aggregation

Organizing units and lots together in a larger aggregation reveals new relationships.

Personalization and customization become important in a setting of similar units.

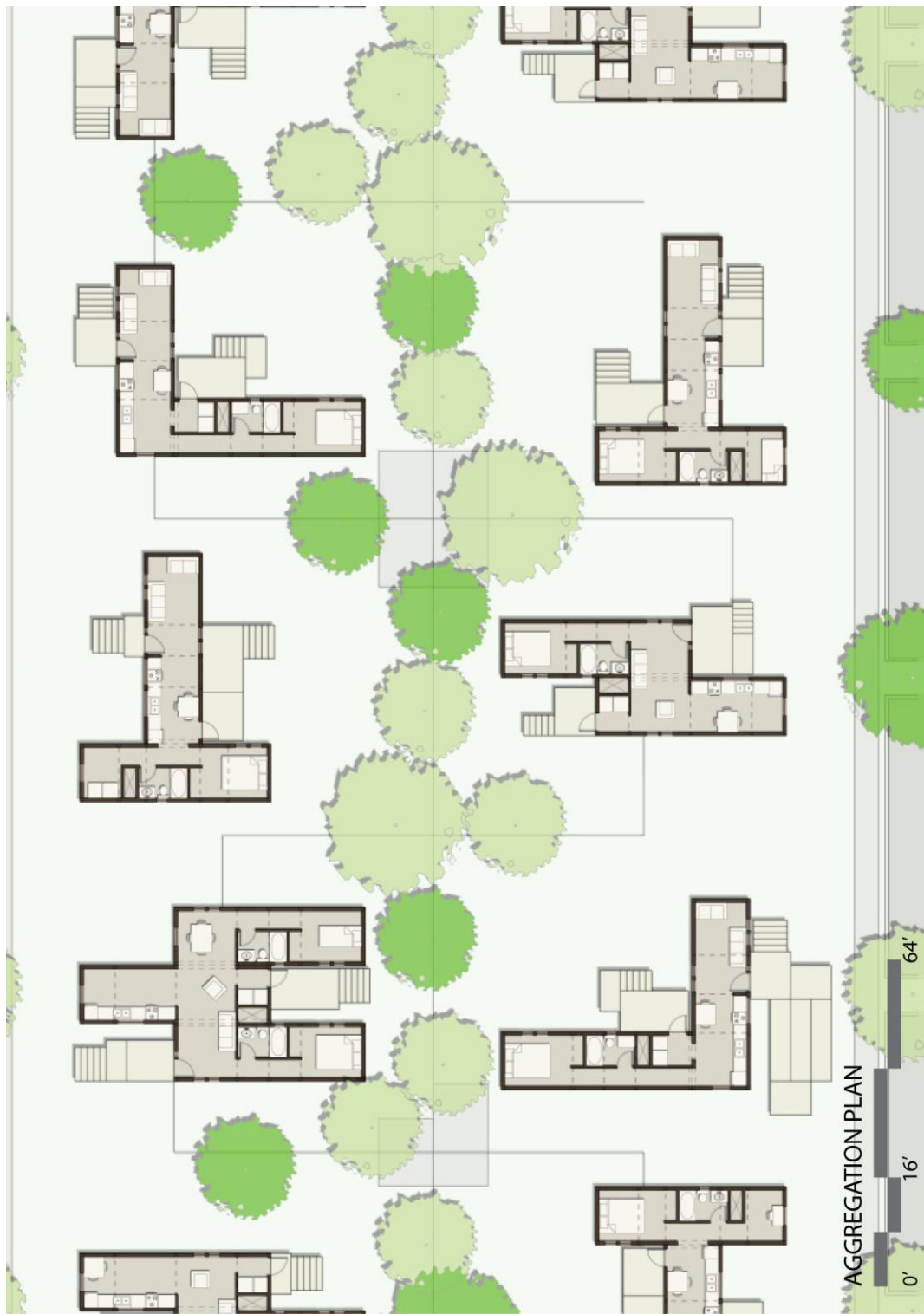


Figure 41 - Variation within Aggregation

Community Design

Based on the case studies of MHI's Communities of Distinction, some of the basic additional elements of a community are:

- Community structure (clubhouse, meeting hall)
- Recreational space (including play space for children)
- Parking (for the units and community centers)

To add to the common factors:

- Sidewalk network
- Street trees
- Hierarchical community design
- Connection to local amenities
- Street parking to preserve yard space

With clear intent to be developed as a residential area, the site in Plano, Texas offers space and accessibility for a test-fit of unit and site design. The site was discovered while looking for open land, about fifteen acres or more, within proximity of public transportation to a larger city. Proposing a manufactured home community in a residential area and away from retail centers begins to counteract previous practice. The proposed community is located within walking distance of a local college, and public transit access to downtown Dallas. Neighboring homes were built within the last 10 years and represent a typical American housing type.



Figure 42 - Site Context Images

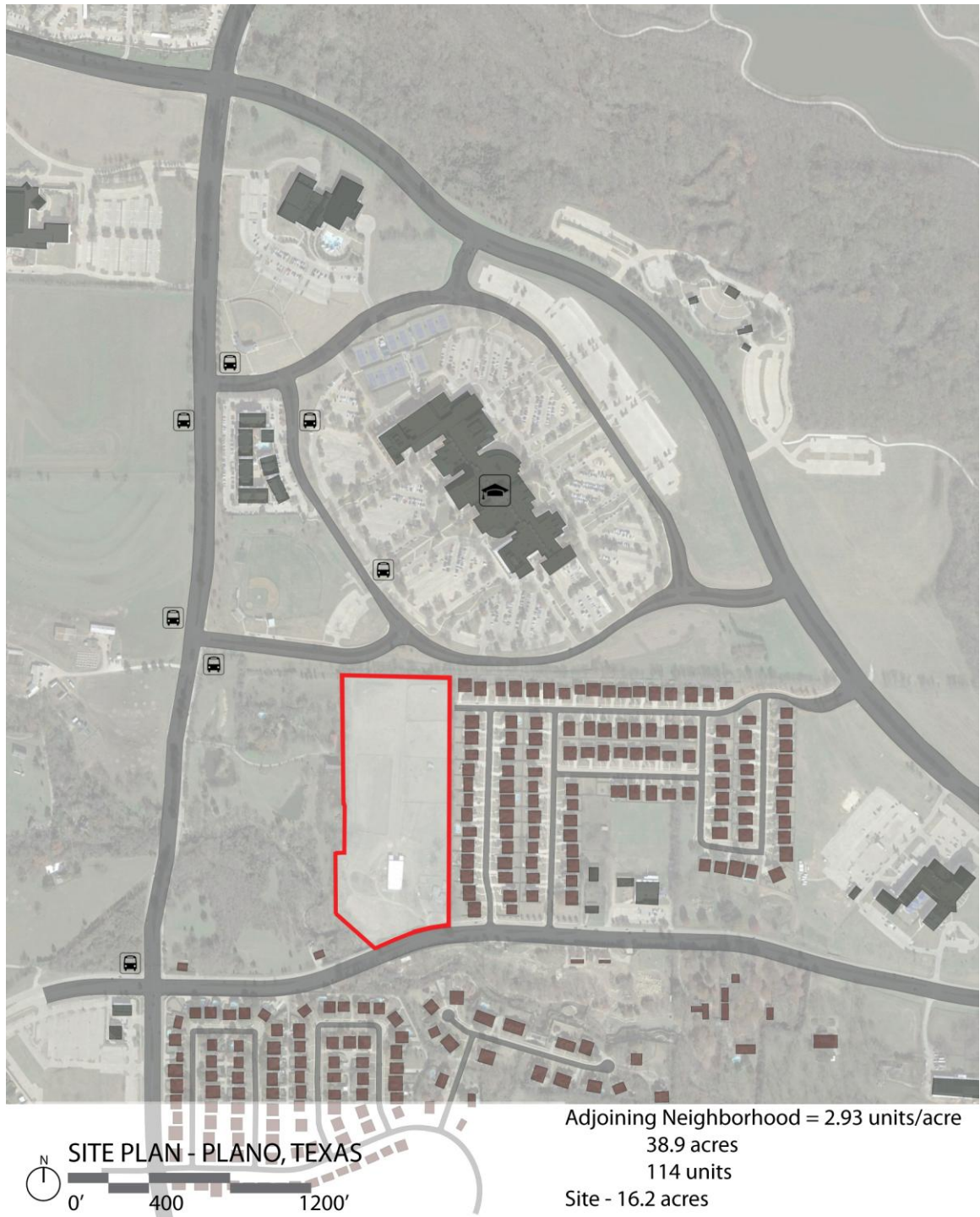


Figure 43 - Site Context Plan



Figure 44 - Site Design - Restricted to 'L', 'T', 'Z' Units



Figure 45 - Site Design with Variation in Permitted Units



Figure 46 - Site Section



Figure 47 - Site Perspective

Chapter 6: Conclusions

Public Review



Figure 48 - Public Presentation Wall

The public presentation took place on April 26, 2011 where many constructive observations were noted. Below is a brief response to the various topics brought to the discussion:

- Stigma
 - Addressing the stigma of the manufactured home is difficult; it stems from many historic and recent factors. Historically shunned for taking advantage of amenities, current stereotypes include manufactured homes being poor quality and for people of lower incomes.
- Additional Features/Parts
 - It was necessary to design and incorporate certain additive features of the home, such as the porches. The idea of designing furniture to accommodate the small spaces and maximize functionality had come into the project at an earlier time. Pulling from design of recreational

vehicles and desire for more space, the concept of movable segments of structure were briefly explored.

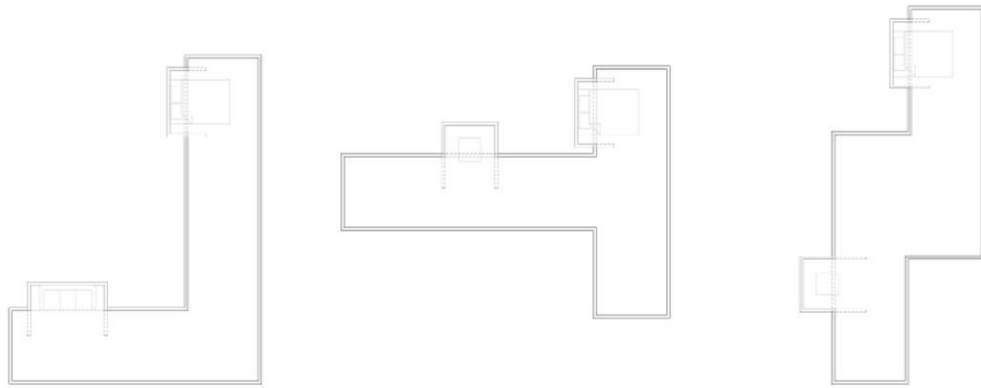


Figure 49 - Space Extension Diagram

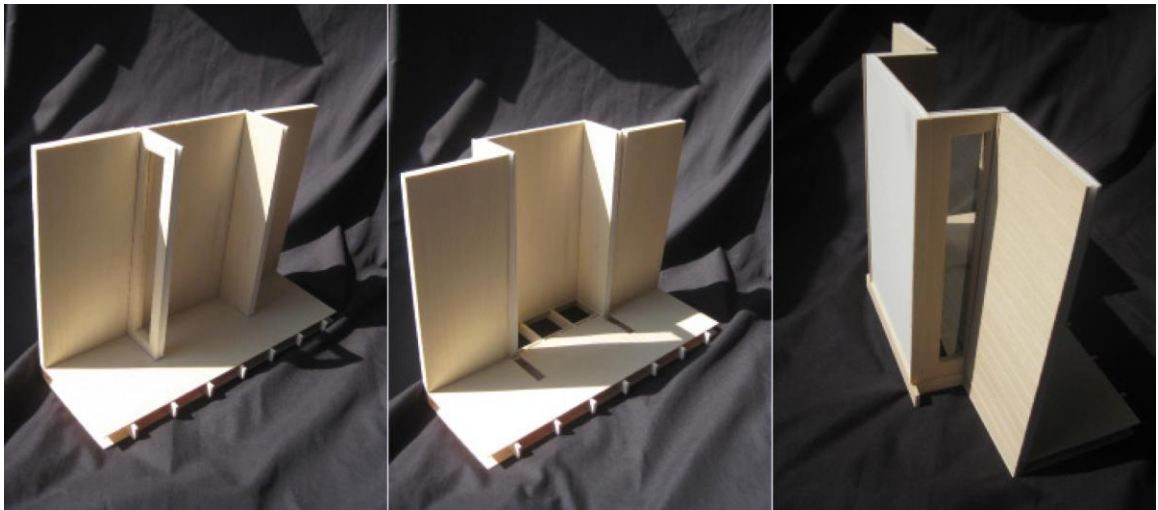


Figure 50 - Space Extension Model

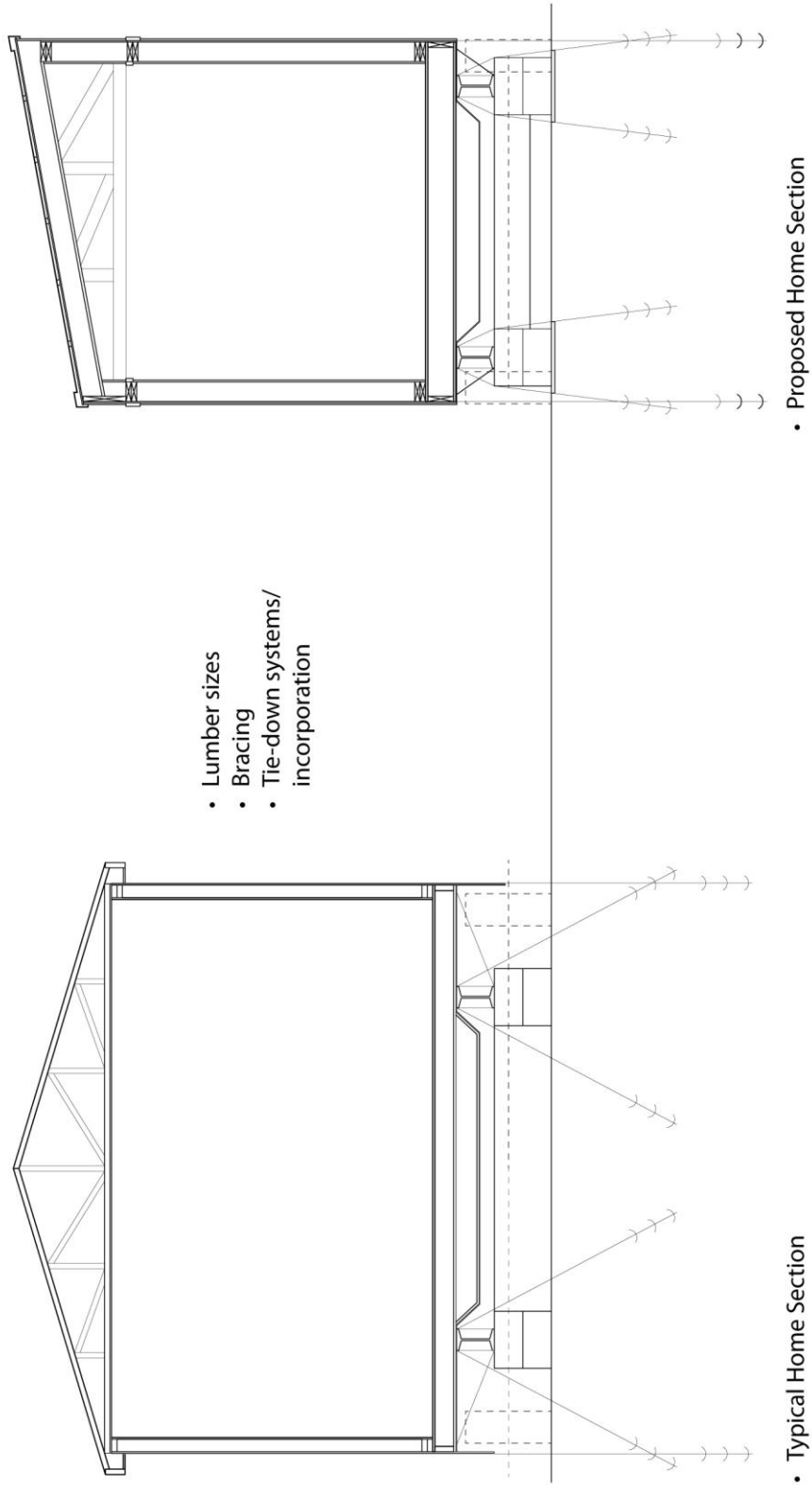
- These studies brought forward the realization that options for additional design elements could be endless.
- Climate and Sustainability
 - Part of the decision to make walls 2x6 studs a standard, even though space would be lost on the interior, makes the homes more

comfortable and sustainable. Climate would have less impact on the interior and the home would have greater energy saving properties.

Comparison

	Conventional Design	Proposed Design
Home Design		
Structure	2x4 Construction	2x6 Construction Truss – reinforces tie down structure
Transportation Cost	Oversize fees	-
Sustainability	-	Water management Energy efficient wall thickness
Community Design		
Density	High density possibility	Medium-High density possibility Visual variation
Yard Space	Undefined by structure	Defined by structure Designated planting space
Paving	Concrete pads and parking	Street parking

Throughout the design process, comparisons were made between current practices and the proposed design. In trying to resolve certain issues such as defined exterior yard space and providing visual variation at the street, some density is lost. Similarly, although 2x6 construction provides better quality insulation and better structural support, it costs more and takes away floor space. A comparison of the typical home section and the proposed manufactured home section in Figure 51 begins to highlight the structural differences. The truss incorporation provides better resistance for wind loads and defined placement for tie-downs.



WALL SECTION COMPARISON

Figure 51 - Section Comparison

Overall Conclusions

As research progressed in the early stages of the project, it was difficult to determine the direction and scope of the thesis. Much of the research revealed interesting design opportunities and areas for improvement of manufactured homes. Having created a logical and developed product which begins to address issues of the industry today, many opportunities remain for improvement. A goal of this thesis was to analyze the history to understand how manufactured housing has become what it is today. The initial identity of the manufactured home was its ability to move, a characteristic which has been diminishing for years. With the realization of this, the main goal of this thesis became to develop a contemporary version of the original idea, a mobile home.

Bibliography

- "2001 CFR Title 24, Volume 5." *U.S. Government Printing Office Home Page*. Web. 15 Jan. 2011. <http://www.access.gpo.gov/nara/cfr/waisidx_01/24cfr3280_01.html>.
- Bair, Frederick H. *Regulating Mobile Homes*. Chicago, IL: American Planning Association, 1981.
- Bartley, Ernest R., and Frederick H. Bair. *Mobile Home Parks and Comprehensive Community Planning*. Public Administration Clearing Service of the University of Florida, 1960.
- Building Codes and Standards Resources*. Manufactured Housing Institute. Web. 15 Jan. 2011. <http://www.factorybuilthousing.com/technical_resources/>.
- Burch-Brown, Carol, and David Rigsbee. *Trailers*. Charlottesville: University of Virginia, 1996.
- Campanella, Richard. *Geographies of New Orleans*. Lafayette, LA: Center for Louisiana Studies, 2006.
- Campoli, Julie, and Alex S. MacLean. *Visualizing Density*. Cambridge, MA: Lincoln Institute of Land Policy, 2007.
- Chapter VII: Roadway Geometry*. Rep. Federal Highway Administration. Web. 15 Jan. 2011. <<http://www.fhwa.dot.gov/reports/tswstudy/Vol3-Chapter7.pdf>>.
- Davidson, Harold A. *Housing Demand: Mobile, Modular, or Conventional?* New York: Van Nostrand Reinhold, 1973.
- Drury, Margaret J. *Mobile Homes*. New York: Praeger, 1972.
- Elliston, Callie, and Cheryl Nafzgar, eds. *Practical Guide to Mobile Homes*. New York: Bantam, 1980.
- Fisher, Thomas. *In the Scheme of Things: Alternative Thinking on the Practice of Architecture*. Minneapolis: University of Minnesota, 2000.
- Harries, Karsten. "9. Tales of the Origin of Building." *The Ethical Function of Architecture*. Cambridge, MA: MIT, 1997.
- Hart, John Fraser., Michelle J. Rhodes, and John Morgan. *The Unknown World of the Mobile Home*. Baltimore: Johns Hopkins UP, 2002.

- Home Builders' Guide to Manufactured Housing*. Upper Marlboro: NAHB Research Center, 2000. HUD. Web.
<<http://www.huduser.org/portal/publications/destech/homeguide.html>>.
- Mays, Arnold H. "Zoning for Mobile Homes: A Legal Analysis." *Journal of the American Planning Association* 27.3 (1961). EbscoHost. Web.
- McDonnell, Lynda. *Mobile Homes: the Low-cost Housing Hoax : a Report*. New York: Grossman, 1975.
- NAHB Research Center, Inc., comp. *Factory and Site-Built Housing: A Comparison for the 21st Century*. Rep. U.S. Department of Housing and Urban Development, Oct. 1998. Web. 15 Jan. 2011. <<http://www.huduser.org/publications/pdf/factory.pdf>>.
- Nutt-Powell, Thomas E. *Manufactured Homes: Making Sense of a Housing Opportunity*. Boston, MA: Auburn House Pub., 1982.
- U.S. Department of Housing and Urban Development Office of Development and Research. *Innovations at the Cutting Edge: New Ideas in Manufactured Housing*. Washington, D.C.: PATH, 1999.
- "Quick Facts 2010." *Quickfacts 2010*. Manufactured Housing Institute. Web. 15 Jan. 2011.
<http://www.manufacturedhousing.org/media_center/quick_facts/default.htm>.
- Rapoport, Amos. *House, Form, and Culture*. Upper Saddle River : Prentice-Hall, Inc. 1969.
- Rust, Adam. *This Is My Home: the Challenges and Opportunities of Manufactured Housing*. Durham: Carolina Academic, 2007.
- Scoates, Christopher. *LOT-EK: Mobile Dwelling Unit*. New York, NY: Distributed Art, 2003.
- Siegal, Jennifer. *Mobile: the Art of Portable Architecture*. New York: Princeton Architectural, 2002.
- Siegal, Jennifer. *More Mobile: Portable Architecture for Today*. New York: Princeton Architectural, 2008.
- United States, Bureau of the Census. *Mobile Homes: Statistical Brief*. Washington DC: U.S. Dept. of Commerce, Economics and Statistics Administration, Bureau of the Census, 1994.

Using and Saving Energy In Homes. U.S. Energy Information Administration. Web. 15 Jan. 2011. <http://www.eia.doe.gov/kids/energy.cfm?page=us_energy_homes-basics>.

Wallis, Allan D. "House Trailers: Innovation and Accommodation in Vernacular Housing." *Perspectives in Vernacular Architecture* 3 (1989)

Manufactured Home Communities, Distincion Program. Manufactured Housing Institute National Communities Council. Web. 15 Jan. 2011. <http://www.mhcommunities.org/cm/community_dist_program/default.asp>.

"Think Smaller: Homes Under 1,000 Sq. Ft." *Dwell* June 2009.

Zeiger, Mimi. *Tiny Houses*. New York: Rizzoli, 2009.